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Deepening the North Star Shaft

By J. Fred Johnson

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More About the African Copper "Menace"

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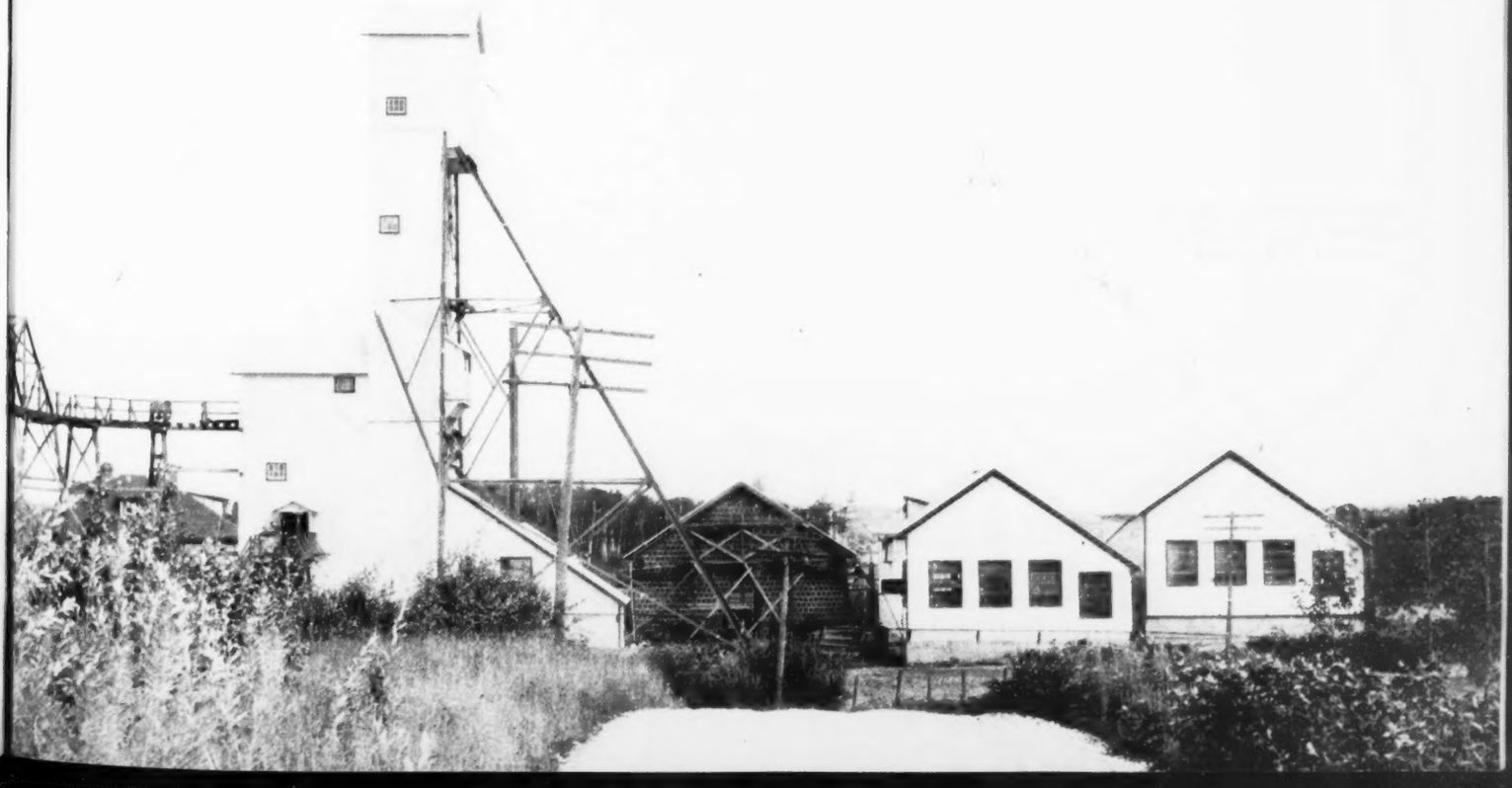
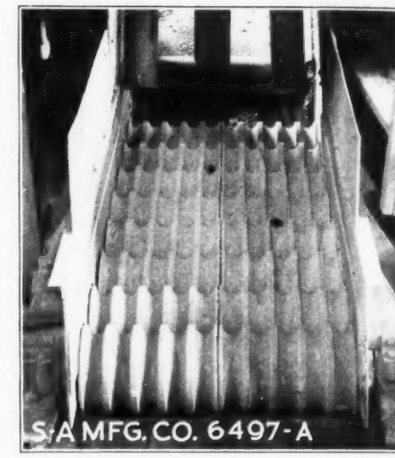
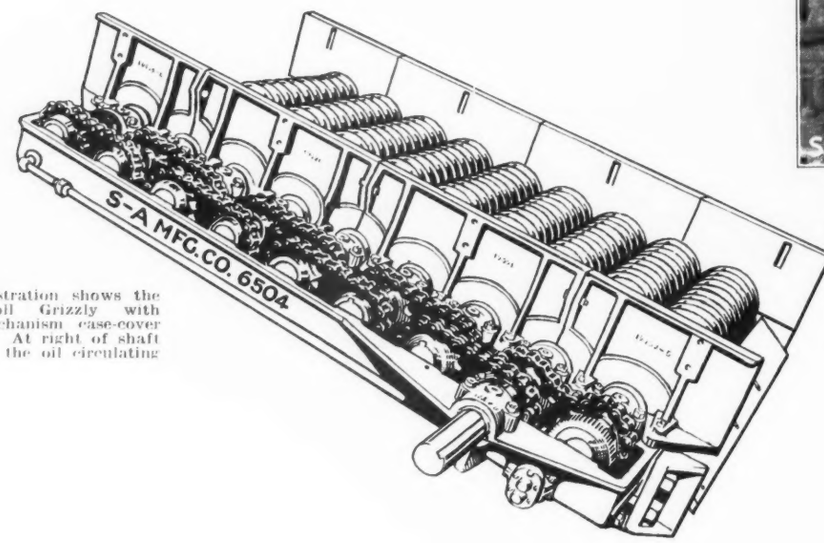
By A. B. Parsons



"Live Roll" Grizzly





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Write for Bulletin No. 149, which describes the Live Roll Grizzly.

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Volume 123 June 11, 1927 *Number* 24

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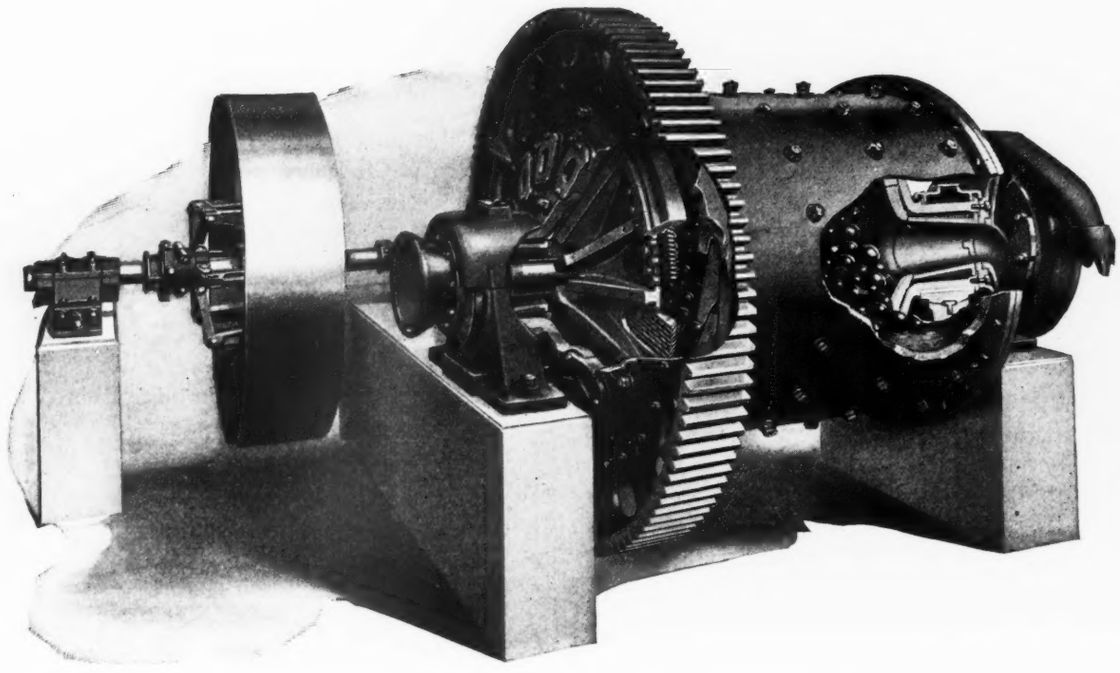

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ENGINEERING AND
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Volume 123 New York, June 11, 1927 *Number* 24

Inspiration's Sensible Course

FACED WITH THE ALTERNATIVE of passing its current dividend—always an unpleasant procedure—or increasing production in a copper market that already is oversupplied, the Inspiration Consolidated Copper Co. has chosen the former course. The combined capacity of the concentrator and the new leaching plant is about 10,000,000 lb. of copper per month. As output from the leaching plant gradually increased during the last six months, decreasing quantities of ore were sent to the concentrator so as to keep production at slightly under 7,000,000 lb. per month, the average rate for 1926. Three months ago, according to L. D. Ricketts, the president, in view of the unsatisfactory condition of the copper market, the dividend rate was reduced from 50 to 25c. per quarter. It was hoped that the price of copper would strengthen. However, it has not done so; consequently the decision to pass the dividend has been made.

Some of the shareholders doubtless will be disappointed. They will argue that the better policy would be to operate at the maximum capacity in an effort to cut costs and increase net income in spite of an unsatisfactory selling price for the metal. They will say that many others are following such a course—so why not Inspiration?

On the other hand, to deplete the company's ore reserve—essentially the working capital of the enterprise—without adequate return cannot, if continued indefinitely, be in the best interests of the shareholders. There is no point in soothing a stockholder with doses of the fallacy that small operating earnings mean profitable exploitation of the property.

The shutting down of the copper mines in 1921 and 1922 drove home the lesson that the complete cessation of production is a tremendously expensive procedure, because of the scattering of the working organization and for various engineering reasons. Accordingly, a complete shutdown of any established mine will be considered only as a final recourse. It is practicable, however, to curtail and thereby conserve the ore until such time as a better market prevails. Naturally the curtailment contributes toward hastening the arrival of that happier era. Determination of the most advantageous rate of production is an intricate problem that can be answered only approximately; apparently Inspiration has fixed 7,000,000 lb. per month as the best figure for the time being. Moreover, it is fair to assume that the officials have reached this conclusion from a consideration of the welfare of their own shareholders rather than a purely altruistic desire to help copper producers in general.

To the onlooker it seems that the copper industry as a whole would profit if the administrators of other companies could convince themselves that Inspiration's policy will in the long run prove the best for Inspiration's *own* shareholders. Their course would then be obvious.

Looking Back on the Geneva Conference

GOODLY ACCOMPLISHMENT can be credited to the International Economic Conference just adjourned at Geneva, which recommended the removal of hampering trade barriers, emphasized the value of an efficient industrial organization as an aid to economic recovery, traversed the function of international industrial pools, and urged international statistics that should result in more intelligent management of industry. The most tangible work was on the removal of trade barriers, for the League of Nations was asked to convene to secure official accords, and the International Chamber of Commerce undoubtedly will push the recommendations. Action seems probable, but results will not follow immediately, as government machinery moves slowly and careful study is needed.

Probably the most notable commercial recommendation is that for tariff stabilization, which would facilitate the making of long-term contracts. America should profit from this as well as Europe. Of the industrial recommendations, that for "rationalization" is especially important—the scientific organization of labor, standardization of material and products, simplification of processes, and improvements in transport and marketing. America is several steps ahead of Europe in these things, though co-operation between labor and capital here has not been as much of a feature as it is hoped to make it in Europe.

Of international cartels, several of which exist in the mining industry, the conclusion is very general, and further study was counseled. A cartel is good if not exploitive; if it seeks to benefit the consumer as well as the producer and avoids the evils that have made some monopolies unpopular in the past. Highly to be commended are the recommendations for the collection of world statistics; fortunately statistics for most minerals and metals are now very complete and in general satisfactory, but still they can be improved in some respects. Such data for some other industries, though, are very poor.

Aside from these recommendations and conclusions, there are broader benefits. The world has now a clearer understanding of its economic ills and knows what the ablest specialists think are remedies; and thus a basis for action is laid. Quick results must not be expected, for the problems are large and complicated. Although the conference was called primarily to consider Europe's difficulties, it must be apparent that America will benefit. The American copper industry, particularly, depends in large measure on the European demand, which can only be large if Europe is prosperous; in somewhat less measure do American producers of lead, zinc, silver, and nickel count on a good market in Europe. Europe in economic health will be a better customer for all of these metals than Europe in ill health. As the International Economic Conference has taken definite steps to improve the economic status of Europe, it would seem to have justified its being.

The Dead Line for Assessment Work

ALTHOUGH almost six years have passed since sections 2324 and 2325 of the Revised Statutes of the United States were amended to change the period for performing assessment work on mining claims from the calendar year to the government's fiscal year, many persons show by their inquiries that they do not understand exactly what the law requires. The change in the law affects all unpatented mineral claims, whether lode or placer, in the United States and in Alaska. At noon on July 1 next the present fiscal year expires. But to state that with it will expire the period within which the annual labor must be done in accordance with the law would be insufficiently informative and in fact misleading. Law has its complications, exceptions, and interpretations. To make this matter clearer, therefore, for the benefit of those who desire such information, certain specific questions that have been asked are answered by a competent legal authority on page 971 of this issue. All claim owners in the United States and Alaska who have assessment work to do will find it worth while to read this discussion.

The Tariff and Preparedness

IN CONSIDERING the advisability of a tariff on certain essential mineral commodities, the idea has been advanced that it is not wise in the development of a nation's natural resources to raise the price artificially of mineral raw materials by means of a tariff and thereby permit commercial exploitation of limited reserves. Such a course is unwise, it is asserted, for the reason that these limited domestic reserves had better be conserved against the day when war's dark clouds may gather and the nation be cut off from the foreign sources on which it has been drawing. This idea should be considered carefully to ascertain its soundness.

First of all, let it be assumed that any one of several minerals that are essential for war purposes, and of which the domestic reserve is limited, is under consideration; that the tariff on this mineral has been removed; that the domestic product cannot compete in time of peace with the imported unless it be protected by a tariff; that being without a protective tariff the domestic industry has become dormant or defunct; and that in consequence the deposits remain untouched. The condition thus brought about is in harmony with the preparedness program advocated by the proponents of the idea. The nation, they say, thus will have its limited reserve of this essential mineral cached, as it were, against a war emergency.

Now assume that war occurs and, as a result, that imports of this essential mineral are curtailed or cut off completely. What will be the results? The length of this hypothetical war is immaterial. If it be short—a few months or a year or two—it will be over before the dormant or dead domestic industry can be revived and the limited mineral reserve be brought into production, if, indeed, in the period of stagnation sufficient research has been done to show how the lean or "off-grade" portion of the reserve can be made usable at all industrially. During a short war, then, what shall the nation do for its supply of this essential mineral? Obviously it must depend for a time at least on whatever stocks it may have had on hand prior to the outbreak of hostilities. Either this or go without. Lazarus came forth from the tomb at the divine command; the dead corpse of the public credit sprang to its feet at the touch of Hamilton; but dead or dormant mineral industries take a longer time to be resuscitated.

If the war be long, a part at least of the mineral reserve may be made available in the course of time. Before it becomes so, however, the situation as to the mineral commodity will be the same as that existing during the shorter conflict, as already told.

Summing up, it seems that a mineral reserve that is too small in tonnage and or too poor in grade to be worthy of protection in time of peace is altogether too undependable to be relied upon to meet the nation's needs in time of war. It seems, in short, that the question of removing the tariff on one of these essential minerals is not at all a matter of preparedness.

"Handsome" Profits for Copper Producers

THE METAL BROKERS and the metal-trade papers of Europe continue very peevish in their attitude toward Copper Exporters, Inc. This, of course, is to be expected, for the loss of commissions on the sale of copper must be a very real one. But in seeking ammunition for the attack on the export association, some commentators go to rather extreme lengths. An editorial in a recent issue of *The Metal Bulletin*, of London, for instance, points out that Kennecott's cost in 1926 was 8c. per lb. and the selling price 14.14c.; Nevada's cost "it is true, was 10.53c. per lb., but against this Utah's cost in the last quarter of 1926 was only 7.4c. The accounts of the Anaconda, Granby Consolidated, Magma, and other big properties all tell the same tale of wide margin of profit between costs and selling prices."

"In the face of all this, one may ask," says the editor, "why is the Copper Exporters, Inc., necessary at all, and why must producers reduce output, seeing that it is evident from their reports they are marketing their copper without difficulty at a handsome profit?"

The sales "without difficulty" and the "handsome profit" will interest those who have been actively engaged in the disposal of copper in the United States during the last three months and who twice have watched the price go down to 12½c. Several flaws might be found in *The Metal Bulletin's* reasoning. Only six of the lower-cost producers were mentioned; perhaps some of them did make a good profit, but how about all the other companies whose costs ranged all the way up to the selling price? How about considering a copper mine as a wasting asset, which it is, though most of the companies do not include an allowance for depletion in reporting their costs? How about the present selling price, which is well below the average 1926 level in which the alleged handsome profits were made? It must be that London has lost a part of that intimate knowledge of the copper industry that it had before American producers decided to sell their own output without the assistance of middlemen.

Engineering Ethics

THIS IS THE TIME of the year when the principles of engineering ethics are brought before the young graduate. As he goes out into practice, he is told how he should conduct himself so as to make his name respected in his chosen profession, and as likely as not he takes an oath to follow the high standards laid out for him, as did the thirty-six gradu-

ates of the Michigan College of Mining and Technology the other day. Two items in this oath follow: "To carry out professional engagements with generous measure of performance and with fidelity toward those whom we undertake to serve. To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other consideration." These are excellent ideals; ideals that are lived up to perhaps as much in engineering as in any profession, and more than in most. As the young graduate becomes experienced, however, he will find that oftentimes he would be better off financially if he had less conscience, and that the principles of his employers will not always be above suspicion.

In fact, one rather inclines to the opinion that the young graduate has higher ethical principles than many of those who have been in the game for twenty or thirty years. He will find that although some of his employers will expect the utmost in loyalty *from* him, they will not necessarily think much about their loyalty *to* him. They will have no hesitation in doing and in asking him to do things which his ethical principles tell him are wrong. They will justify themselves, doubtless, on business principles; competition forcing them to take every advantage that they can. But it is unfair for all the ethical principles to be exercised on the employee's side and all the business principles on the other. It would not be proper to suggest that the graduate lower his ideals; rather should the suggestion be made that the employers in the industry keep the high principles of the engineer more fully in mind, and not force the new members of the profession to temper their ideals too much with expediency.

Five Dollars a Day for Miners

HENRY FORD'S minimum wage of $5 per day is not confined to his automobile shops, but applies to the work done at his Idaho mining properties as well, as Stewart Campbell mentions in his report of the mining industry in Idaho during 1926. Ford's lead properties in Idaho embrace the Red Bird and South Butte groups, in Custer County, and during the year an average of seventy-five men were employed. All employees start at a wage of $5 per day, which is automatically increased to $6 a day at the end of two months. Thereafter, further increases depend upon the manager's opinion of the worth of the employee's services. These wages are above the level commonly paid in Idaho, and the natural result would be that Ford would get the best men available and that his labor turnover would be small, which would, presumably, be sufficient return to make the increased wage profitable to employer as well as employee. Of course, the idea of setting a minimum wage well above the general level is one that can be adopted by one or even all employers in a single district with possible advantage; but if too many employers in too many districts should decide on such a policy, the benefits would diminish, as there would not be enough superior men deserving of the higher wage to go around.

Then, too, there is another aspect to the situation: A universal $5 minimum wage is doubtless good advertising for Ford, but living expenses in many mining camps are by no means so great as in a city like Detroit. Proper wage scales are largely a local matter. This has been brought out only recently in the discussion of an increase in the pay of postal employees. City employees in this branch of the government service have doubtless been underpaid, but it should not be argued from this that an increase in the wage scale of all government postal employees is justified.

Weepah's Boom Short-Lived

WEEPAH, NEV., about which so much was read in the newspapers a few months ago, has not become the boom town that so many promoters, beach-combers, gamblers, movie magnates, and real-estate sharks hoped. The Tonopah Divide fiasco, for instance, has not been repeated; and it is well. Frank Horton, whose seventeen-year-old son made the phenomenally rich surface discovery, has preferred to go slowly and conservatively in developing his property and has refused to have dealings with the gentry that were so anxious to benefit him and themselves at the expense of the public. As a result, only about seventy men are now employed in the district, and the vendors of the inevitable "hot dogs," sandwiches, and cull oranges have had lean pickings. The district is not dead, however, so far as the prospector and honest developer are concerned. Some good showings have been made, and a few bags of high-grade ore shipped. A real mine or two may be developed.

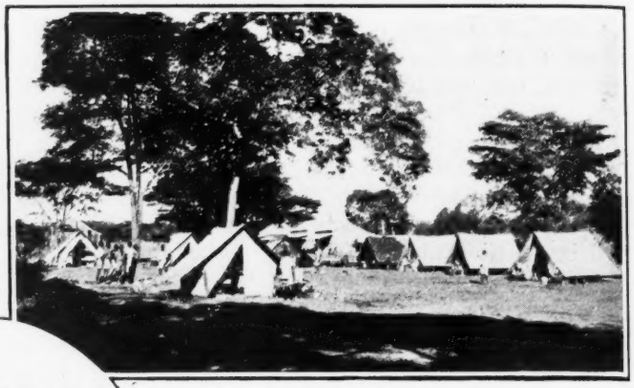
By the Way

STATISTICS just issued by state officials show that in 1926 the iron mines of Michigan produced 5 per cent more ore than in 1925, but that the number of men required was smaller by 5 per cent. The reason assigned for the improvement in per-ton-shift figure is the increased use and improved design of small hoists and scrapers for mechanical loading underground. Another illustration of the steady movement to make electric power or compressed air, instead of the muscles in human arms and backs, do the heavy work—and to the great advantage of everyone concerned.

Engineering News-Record has been compiling a list of the various kinds of engineers and engineering, the latest installment bringing the known number up to 230 and including "Results Engineer," which is said to be "a new breed coming to be quite common in public utility companies," and "Fumigating Engineers," "a variation of our old friends the 'exterminating engineers'." In a recent issue of the *E. & M. J.* some may have noted a personal note concerning a "boring engineer." Many might be called that, but few cling to the title.

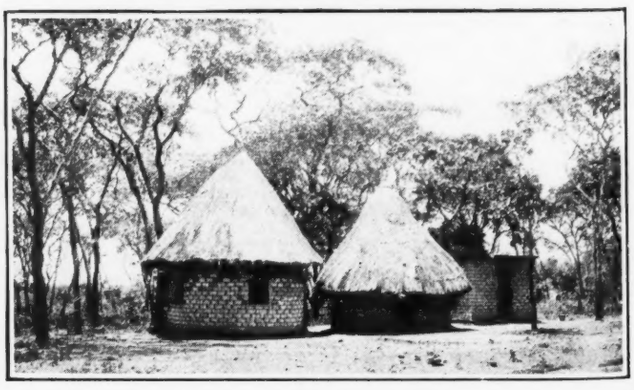
APPARENTLY one of the easiest things in the world is to get into the growing fraternity of professional engineers. By comparison to joining the Elks or the Methodist Church—merely by way of example—it is no trouble at all. Not long ago the American Society of Bakery Engineers held a convention in Chicago. It is true that there are more bakeries than there are mines in the world, but one wonders just what processes in the manufacture of bread absorb the attention of the engineers. More fascinating still is speculation as to the functions of the gentleman who prints "Insurance Engineer" after his name, and is manager of the service bureau of a Brooklyn insurance agency. Engineer is a name to conjure with!

On the Rhodesia Congo Border Concession



Above — Only means of mechanical transportation on the Concession. Right—A native citizen touring the country. Below—Arrival of the first motor car at Kasempa Boma. The tall man in the center of the group is Raymond Brooks

Above—Camp at N'dola, on the railroad near Bwana M'Kubwa. Lower left corner — N'Changa mine plant, showing timber headframes. Lower right corner—Quarters at N'Changa of H. H. Fraser, who is in charge during Mr. Brooks' absence



More About the African Copper "Menace"

An Interview with Raymond Brooks, Manager for Rhodesian Congo Border Concession

By A. B. Parsons
Associate Editor

"WHAT is the first question" was the first question I asked Raymond Brooks, manager of the Rhodesian Congo Border Concession, Ltd., who is on a six months' leave of absence, "that engineers in the United States generally ask when they get an opportunity to quiz you?" That was doubtless a lazy approach on the part of the interviewer, but I was curious to know if others wanted information on the point that most interested me. Apparently they did. Mr. Brooks told me that the first thing everybody wants to know is "How much copper is central Africa going to produce; and how soon, if ever, will it be contributing to the world's output, say, as much as Arizona, or about 750,000,000 lb. per year?" This is a question much more easily asked than answered. As might be expected, Mr. Brooks prudently avoided any specific reply; and yet what he said was highly significant. He warned me frankly that he was perhaps overly enthusiastic about the possibilities of the country, particularly about those of Northern Rhodesia. He pointed out the fact that progress must of necessity be slow; conditions are not favorable for rapid exploration, rapid development, nor rapid equipment of a proved deposit for actual exploitation. The only present-day producers are the Union Minière, in the Congo, and Bwana M'Kubwa in Rhodesia. Fairly rapid progress up to the nominal capacity of the present plant—something less than 2,000,000 lb. per month—may be expected at Bwana M'Kubwa; but expansion by the Union Minière is progressing slowly. The labor problem is becoming more serious. As to new producers of importance: five years, ten years maybe! There is little use in trying to make even approximate estimates as to production figures. However, as to the existence of deposits of copper ore, Mr. Brooks was willing to talk more specifically. Regarding the 52,000 square miles—an area somewhat larger than the State of New York—in the concession being prospected under his direction, Mr. Brooks said: "I know of no other region of comparable size where copper occurs so generally and so consistently. Every type of geological formation thus far found on the concession has in some locality been found to contain copper. I do not mean that the copper content necessarily has been sufficiently high to make ore or even near-ore, but all kinds of rocks are possible loci of ore deposits. The point to emphasize is that copper mineralization is so widespread. We had for example up to Jan. 1 made 141 distinct discoveries that warranted serious investigation, and only a small part of the area has been even roughly prospected. The possibilities are almost unbelievable. Regarding a comparison with the deposits of the Union Minière in the Katanga region, work thus far indicates that deposits in Northern Rhodesia, though in most instances of lower grade, will surpass in tonnage any individual mines heretofore found in the Congo. Moreover, the sulphide character of the ore will be a favorable factor because of its greater amenity to treatment."

Raymond Brooks

In reply to a question as to whether he could give any actual figures, Mr. Brooks said: "Well, in the Dambo lode, in the N'Changa area, estimates of the indicated ore are 40,000,000 tons, with every evidence of a further increase both in depth and along the strike. The lode has been drilled for a distance of 3,200 ft. on the strike, and the results of sampling show remarkable consistency in the tenor of the ore ranging between 3 and 4 per cent copper." Quite evidently here is more than a nucleus for a remarkably big mine, and Mr. Brooks seems to have faith in the belief that many such lodes will be developed in Northern Rhodesia.

Ray Brooks, by the way, is an American. He graduated from Princeton in 1904, and from a stiff course in the Mining School of Practical Experience, in Goldfield, Nev., about six years later. Subsequently he worked at the Ray Con., in Arizona, and in 1916 drilled the Flin Flon property, in Manitoba, for the Jackling interests. He then made examinations in various Western states and in British Columbia for the United States Smelting, Refining & Mining Co.

In 1920 Mr. Brooks was engaged by Archer E. Wheeler, consulting engineer in New York for the Union Minière, to go to Africa to take charge of exploration and development in the western area of the company's huge concession in the Katanga. Two years

later when the Rhodesian Congo Border Concession group was preparing for active exploration, Mr. Brooks was selected to become manager. His first task was to organize the work. In May, 1923, he took the first party into the field. Before him was an area of more than 50,000 square miles that had never been prospected by white men and that was inhabited only by natives, who knew nothing about the work. Of course, there were no railways and no roads. But there was copper. The natives had gouged out copper ore in crude workings, and plenty of evidence was at hand of the existence of the metal. The problem was to find the deposits that warranted development. Mr. Brooks put enthusiasm and energy into the work, and accomplished wonders in the next forty months.

SHORTAGE OF LABOR IN KATANGA

Regarding the general conditions in the country he said: "The area is a plateau between the sources of the Zambezi and Congo rivers, having an elevation of about 4,200 ft. It is open country and easily prospected except for the scarcity of outcrops. Malaria exists and quinine is part of one's regular diet, but otherwise the country is healthful. We employ 3,000 natives, whose services are voluntary. By that I mean that they are not recruited, as is necessary at the gold mines. They are paid the equivalent of $8 per month in addition to food and 'compounding,' which is the African equivalent of board and lodging. They eat mealie, peanuts, beans, rice, and salt, with game for meat." "Yes"—in reply to a question—"I have killed several lions, one from my motor car. I have raced with zebras and have been in more intimate contact than I sought with crocodiles, 'hippos,' and elephants."

With reference to the question of labor shortage, which has become quite important in the Katanga copper operations, Mr. Brooks had this interesting comment: "Operators in Northern Rhodesia have less reason for apprehension on this score than has the Union Minière. There are in the colony about 80,000 natives of suitable age who have the capacity for the kind of work required. For several years the Union Minière has recruited a considerable proportion of its force from Northern Rhodesia under an arrangement with the government. As the copper industry in Rhodesia expands, the natives will prefer to work nearer home, and it is probable that recruiting will be discountenanced for work in other than British territory. Another difference is that the Katanga deposits individually are smaller than those in Northern Rhodesia. For this and other reasons more labor per unit of production will be required in the Union Minière operations. The mechanization of operations, and the introduction of large-scale methods, are likely to be developed to a greater extent in Rhodesia.

TRANSPORTATION IMPORTANT FACTOR

"Naturally transportation is important. To facilitate the distribution of supplies and permit the careful supervision of prospecting and development, 650 miles of motor roads have been built; and the program for 1927 calls for an additional 350 miles. This comprises a carefully planned system of trunk and branch roads. The following inventory of motor-car equipment shows the popularity of American automobiles: For heavy transport over the 17-mile highway connecting N'Changa with Tchinsendo, the nearest railroad point, a Sentinel roadless steam tractor drawing a train of three trailers having a capacity of ten tons each; for light transport, one Chevrolet, one Graham Brothers, and one F.W.D. truck; for passenger service, one Studebaker, one Dodge, and six Ford cars."

Eventually a railroad should reach N'Changa. A railway survey has been made from N'dola, on the main line of the Rhodesian Railways, to the N'Kana mine of the Bwana M'Kubwa company. The distance is about 35 miles, and a further extension of 45 miles would bring the line to N'Changa. The country is comparatively flat and offers few difficulties to railway construction.

Mr. Brooks outlines the scheme of operations as follows: "Our object is to prospect the entire concession systematically. When an area has been covered we want to feel reasonably sure that we have missed nothing. The first phase we call 'general prospecting.' The party—there have been fifteen in the field—is headed by an experienced prospector, usually obtained from some of the mining districts in South Africa. He has as an assistant a junior engineer, a young college graduate whose duties include, among other things, the making of a survey with a prismatic compass. Twenty natives, including workers, carriers, and runners, comprise the party. The function of general prospecting is to find mineral in place and dig shallow pits or trenches to expose the deposit superficially. The country is checkerboarded in 10-mile squares, to prevent the overlooking of any area. The territory is divided and the work supervised by two high-grade men, each with the title of division engineer.

AMERICAN ENGINEER HEADS PROSPECTING STAFF

"A separate organization conducts the next phase of the work — or 'preliminary development' — under the supervision of an American engineer and an assistant. The individual parties, five to eight in number, are composed of forty natives headed by an experienced practical miner — white, of course. They demonstrate whether the discovery is of size and character to warrant further work. Hand methods are used, with about 100 ft. the maximum depth of sinking. If this work proves favorable, intensive development with core drilling, shaft sinking, and drifting is undertaken, a camp of comparative permanence being established for the purpose. Steam hoists, compressors, and air drills are provided. At the first of the year five such projects were under way."

Electrical prospecting by the equipotential method under the direction of A. Broughton Edge, a British geologist, has been used to good advantage as a quick and cheap method for getting evidence on which to choose spots for core drilling and shaft sinking. Mr. Brooks cited some rather remarkable examples of the exactness with which subsequent work confirmed the predictions based on electrical surveys. All in all he seemed to be well pleased with results. At any rate he has plans for an enlarged program of electrical prospecting during 1927.

Likewise a contract has been signed with the Aircraft Operating Co., Ltd., which has sent a de Haviland plane with a staff of eight men to make photographic surveys. A reconnaissance survey of 10,000 square miles and a detailed map of 2,000 square miles are to be made. The idea is to determine and to check the regional geology, and perhaps to detect and locate native mine workings that might be missed by the general prospecting parties.

"The white staff on the concession now comprises about 300 men," said Mr. Brooks, "of whom twenty-five are technical graduates. Of these, eight or ten are from the United States or Canada. H. H. Fraser, who is in charge of the work during my absence, graduated from Pennsylvania State College in 1921. Louis E. Reber, Jr., the chief of a geological corps of four, is 'borrowed' from the United Verde Copper Co. A number of wives are with their husbands, but they are not permitted to go farther into the bush than the main base camps. Including wives, sisters, and visitors there are more than fifty white ladies on the concession." As to whether he would advise a young American engineer to take his wife to Africa, Mr. Brooks did not commit himself. This reticence is rather surprising, incidentally, in view of rumors that have emanated recently from Park Ave., New York, and that seem to suggest that the manager of Rhodesian Congo Border may not return to Africa alone.

Separate Companies Organized for Exploitation

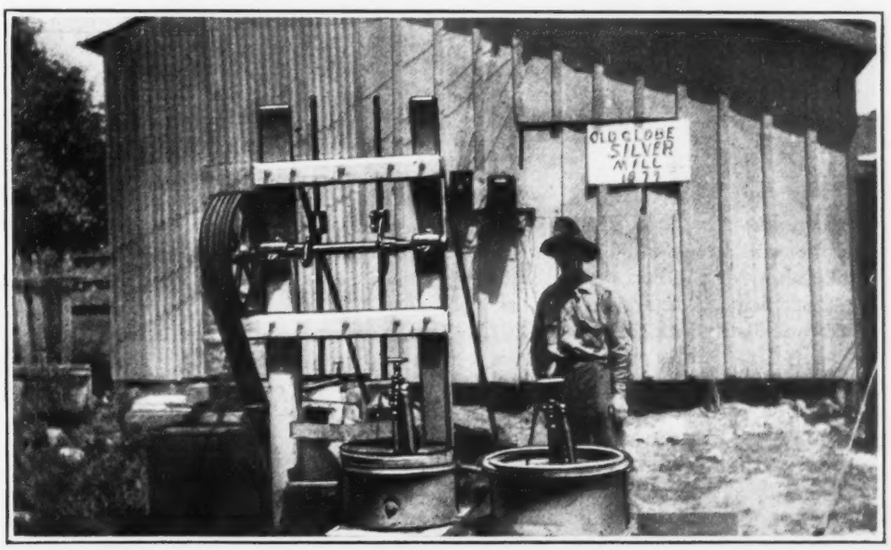
"What progress has been made to date in intensive development?" In reply to this question Mr. Brooks explained that the most advanced work was at N'Changa. Under the plan of exploitation a company known as N'Changa Copper Mines, Ltd., in which Rhodesian Congo Border Concession holds a 43 per cent interest, has been formed to complete the development and to equip and operate the N'Changa property, which covers an area of about 4½ square miles. "Here," Mr. Brooks said, "there are two 'showings,' the Main and the Dambo, which may prove to be limbs of a synclinal fold. The Dambo appears to be the more important. It is described as a feldspathic quartzite and is from 80 to 90 ft. thick. Two inclined shafts are being sunk, with the depth of 1,500 ft. as the objective; and extensive crosscutting and drifting will supplement the development already done, which includes core drilling. N'Changa is the place where I ventured the estimate of a minimum of 40,000,000 tons of ore.

"A second development center is Mimbula, 10 miles south of N'Changa. Here the geological conditions and mineralization are in many respects similar to those at N'Changa. Basing an opinion on the indications available to date, Mimbula ought to prove as big or bigger than N'Changa. Systematic pot-hole drilling down to the water level on an area 1½ by 2 miles has been very encouraging. An interesting feature is revealed by the following progressive results from one core-drill hole: first bed, 3.3 per cent copper, 64 per cent sulphide; second bed, 2.4 per cent copper, 98 per cent sulphide; third bed, 5.3 per cent copper, all sulphide. The upper bed is leached and the lower one shows unmistakable evidence of secondary enrichment.

"At Lunsemfwa, east of N'Changa, numerous lenses of primary sulphide ore have been found in granite. Twelve shafts having an average depth of 125 ft., equipped with compressors and hoists, have been sunk, and the outlook is encouraging. The fourth center of intensive development is in the Southern District. At Chifumpa a replacement deposit in dolomite has been developed on the 100-ft. level over an area 800 by 60 ft. The ore ranges up to 12 per cent copper in carbonate form, and averages 6 per cent. Several other similar deposits are being opened, but at none of them has work progressed as far as at Chifumpa."

As I understand it, the Rhodesian Congo Border Concession expects to confine its activities to prospecting for minerals and marking out mining claims according to the terms of its agreement with the British South Africa Co. Actual exploitation will be done by companies like N'Changa Copper Mines, organized to take over specific deposits. Mr. Brooks' job consequently is exploration and preliminary development. Probably he has in charge the biggest task of its kind ever yet undertaken. On the other hand, he has tools that never before have been so readily available. Outstanding among them are the electric survey and the aërial photographic map. Still, it is significant that the preliminary development parties do their work by sinking small round shafts by hand—to depths as great as 100 ft. Even now the only way to be sure of ore is to dig for it.

Ten years ago the copper world began to wonder about the quantity of the metal that interior Africa would be able to supply. It has been wondering ever since. Mr. Brooks, prospector extraordinary, ought to know as much about it as anyone; he believes that the production eventually will be tremendous. Some comfort may be derived from the fact that the incidence of any large new output lies a considerable number of years in the future, and by that time the world may need all that can be produced.



An exact replica of a stamp mill used for crushing silver ore in the Globe district, Arizona, fifty years ago. It was made by John Nicholls, of Globe, for exhibition during the Elks' Golden Jubilee, held at Globe April 20 to 23, 1927.

Deepening the North Star Shaft

Novel Plan for Replacing Long Incline for Main Hoisting Operations

By J. Fred Johnson
Contractor and Consulting Mining Engineer, Eureka, Utah

PLANS for extending the vertical shaft of the North Star Mines Co. at Grass Valley, Calif., were tentatively announced in the company's annual report of 1923. Work was started in May, 1925, and the vertical sinking completed in November, 1926. Connection

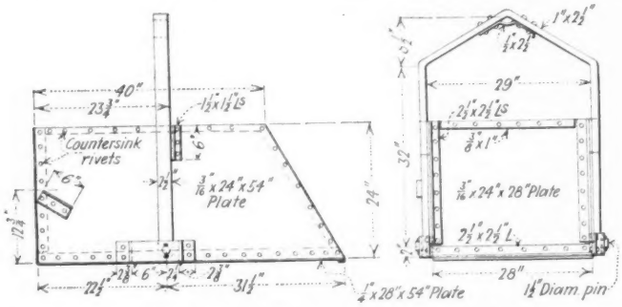


Fig. 1—Loading pans similar to those used at Butte but slightly larger

with the upper part of the vertical shaft was made in March, 1927, and the completed shaft placed in service. In the interim the 8,600 station was constructed as well as pump chamber, sump, and ore and waste pockets. The planning of the work was under the direction of Arthur B. Foote, general manager, and the work of sinking was done under contract.

Conditions at the beginning of the work were as follows: A 1,600-ft. vertical shaft connected with an incline which followed down upon the dip of the vein to the 6,300 level of the mine. At this point the North Star vein is cut off by the Pennsylvania vein, which dips in the opposite direction. As development and stoping were extended down upon the Pennsylvania vein it became necessary to introduce a second hoisting stage, and operations were generally unsatisfactory. To overcome this condition, the decision was reached to extend the 1,600-ft. vertical shaft to a sufficient depth to intersect the Pennsylvania vein upon its dip. In addition two winzes, one from the 6,300 and one from the 6,000 level, were decided upon for development purposes.

Sinking the Vertical Shaft

In preparing for the sinking of the vertical shaft a 45-deg. incline was sunk from a point a short distance in the footwall at the 4,000 level on the North Star vein, approximately at the bottom of the 1,600-ft. shaft, leaving a rock pentice of about 15 ft. in thickness. Shaft sinking was started at the bottom of the 45-deg. incline. A curve of 10-ft. radius connected the incline to the new vertical shaft. This was served with a double-drum, motor-driven hoist equipped with a 100-hp. motor and two sinking skips of special construction, shown in Fig. 5. A "runaround" upon an 8 per cent grade was provided, connecting with a pocket on the upper shaft, opposite the side upon which was placed the incline, as shown in Fig. 2. One skip was used in the center compartment for hoisting waste rock and the other as a counterbalance. Either skip could be used independently for handling supplies.

The shaft contains three compartments, two 4 by 5 ft. and a third 5 by 5 ft. in cross-section. It is timbered with 8 by 8-in. timbers, sets 5-ft. centers, with bearing sets 250 ft. apart. Each bearing set consists of timbers placed in hitches and under end plates and dividers. The over-all rock section measures 7 ft. 8 in. by 17 ft. Guides are 4 by 4 in. and 30 in. in length. In addition four 20-lb. rails are placed in the positions shown in Fig. 3. These serve to engage the wheels upon the skips. The shaft was completed as sinking progressed.

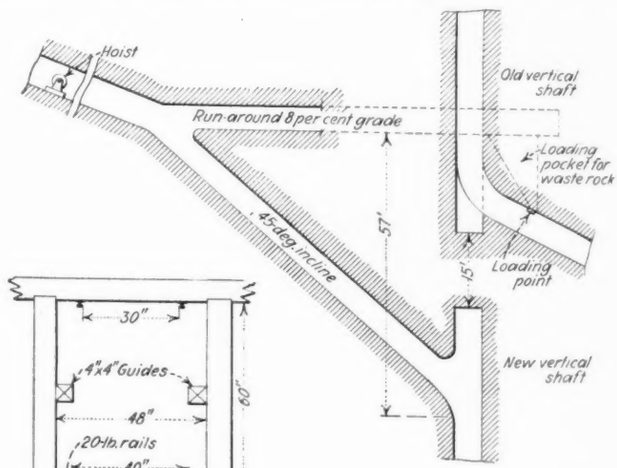


Fig. 2—(Right) Arrangements for handling waste rock hoisted from new shaft section and delivered to loading pocket discharging to skips in old shaft; and Fig. 3—(Left) Plan of shaft compartment

The shaft is in granodiorite and diabase, both hard, firm rocks that stand well and which do not weather appreciably. The diabase is much the harder rock, this fact being indicated by the requirement of about twenty pieces of steel to drill a 7-ft. hole, whereas the granite usually required only seven pieces of steel.

The layout of the round is shown in Fig. 4. A center V cut was made, the advance per round being 5 ft. Forty holes were drilled in the section, the aggregate drill footage per round being about 225 ft., or 0.375 ft. of drill hole per cubic foot of rock broken. The area of the rock section is about 120 sq.ft. and the cubic contents per round 600 cu.ft.

The center V cut was broken by loading three 1¼-in. cartridges of 60 to 80 per cent explosive in the bottom of the cut holes and the remainder of the charge consisted of 40 per cent explosive. Other holes were

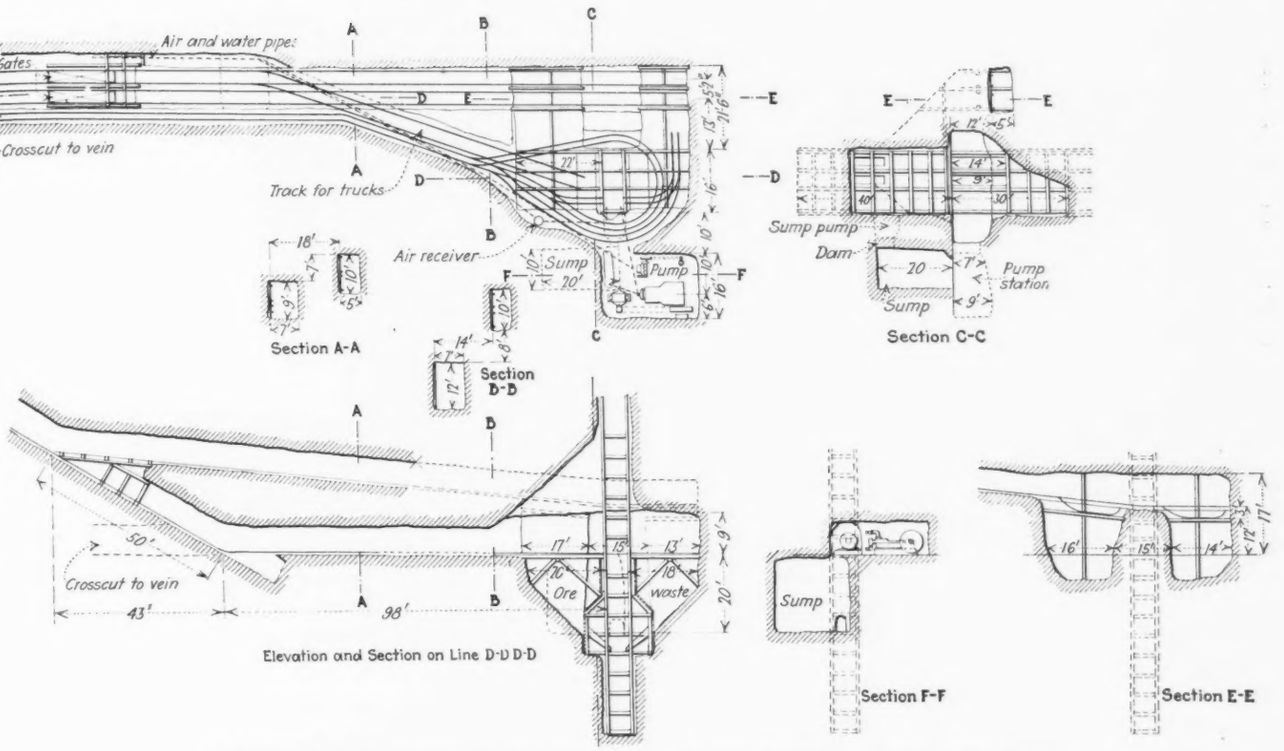


Fig. 6—Plan of station on the 8,600 level, at the bottomof the vertical shafts

charged with 40 per cent explosive. Charges were tamped, using clay stemming in paper carriers. Electric blasting caps in eight delays were used for detonation. Some trouble arose from misfires resulting from too low a voltage on the firing current. A current of 110 volts was first used, and this was increased to 220 and finally to 440 volts, after which there was no more trouble

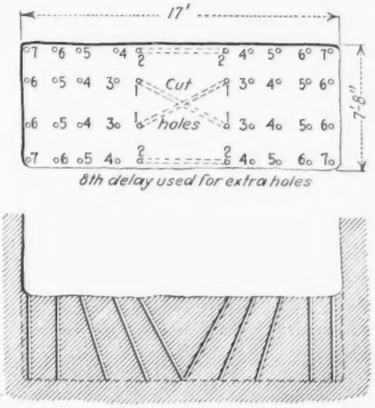


Fig. 4 — Standard drill round showing order of firing

from misfires, until the 1,300-ft. point was reached, when the blasting switches were removed to the 1,000-ft. point, and trouble was again avoided. A misfire was handled by blowing out the stemming, using the blowpipe for this purpose and putting in new primers. Consumption of explosives totaled 2½ boxes, of 125 lb. per round. This is approximately 0.21 lb. per cubic foot. The ground broke blocky, but the largest pieces seldom exceeded 100 lb. in weight.

Drilling was done upon the day shift. The crew consisted of eight drill runners and one nipper or tool rustler. Denver drills, No. 37, were used upon the work, four drills being kept in reserve. A 6-in. compressed-air pipe was installed in the shaft, and from the end of this two 50-ft. lengths of 2-in. hose connected with the manifolds, each of which served four machines, one blowpipe, and an extra machine held in reserve. A hose length of 12 ft. connected the machines to the manifolds. A 50-ft. length of 1-in. water hose connected with a manifold serving nine hose, each one with a small valve at the manifold. Water was not used through the drills, but the ends of the hose were placed at the top of the drill hole and water allowed to run in. A 1-in. water pipe was placed in the shaft and was supplied with water from a barrel which received its supply in turn from watercourses on the way down. Drill steel was 1-in. hollow hexagon with collars. A single round required a maximum of 480 pieces of drill steel, but ordinary rounds averaged 275 pieces. A device for removing broken steel from drill holes is worth mentioning. For this purpose a 6-ft. length of mild steel, ½ in. square, tapered to a long point, was driven into the hole on the end of the broken piece of drill steel and the steel pulled out. A single point could be used two or three times before repointing. This device

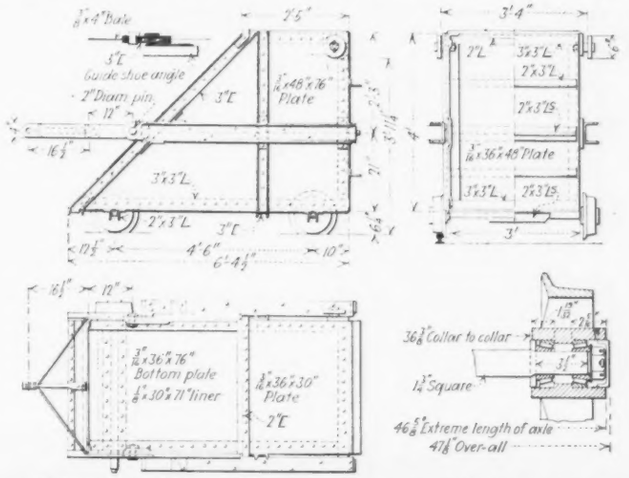


Fig. 5—Sinking skips of two-ton capacity, for use in vertical shaft

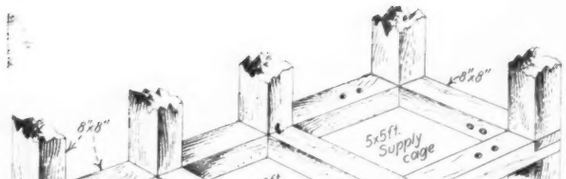


Fig. 7—Detail of timbering for vertical shaft

made an important saving, as sometimes as high as twelve holes in a round were retrieved. Air pressure was 90 lb.

AMPLE PROVISION FOR VENTILATION

Ventilating air was supplied by a 12-in. galvanized-iron air pipe which was extended down the shaft and connected at the top to a fan operated by a 15-hp. motor. On the open end of the pipe was connected a tee on one branch of which was attached a length of flexible tubing and on the other a butterfly valve. The fan was operated as an exhaust for twenty minutes after blasting, the butterfly valve opening and the flexible tubing collapsing. After this interval air was forced down the air pipe. The total depth sunk was 1,940 ft., and this was without connections or other openings. Lighting was by carbide lamps, although some electric lights were used, a cable being carried down in the shaft for this purpose.

A blasting bulkhead of special construction was found necessary to overcome the effects of heavy blasting. Several other bulkheads were tried and found useless. This special bulkhead was constructed of 8-in. steel I-beams. Rivets were used to connect the parts. Beneath the bulkhead 6 by 8-in. timbers were placed and held up by steel rails and U-bolts. Four hooks, $\frac{3}{4}$ by 3 in. in section and 8 ft. in length, carried the weight of the bulkhead, the hooks being placed on the wall side of the timbers. In addition chains were also used as an extra precaution. The blasting set was blocked to the timbers on the lowest set above the bulkhead. The blasting set also served as a staging from which the shaft timbers were erected. It was lowered by chain blocks or by small air hoists. Two of these were available. To place a new shaft set, the bulkhead was raised, the hooks removed and hung upon the bottom set and the bulkhead lowered to its new position. This provided sufficient space for the new set.

"MUCKING" WASTE ROCK INTO STEEL PANS

Waste rock was handled by the Elm Orlu method described by Drullard in his recent article in the *Engineering and Mining Journal*. The loading pans were made slightly larger, as shown in Fig. 1. Rock was mucked into these pans, of which there were two, one on either side of the sinking skip. They were handled by small air hoists. Extension rails specially designed were lowered after each blast and raised on the completion of drilling to a height of 50 ft. The extension rails are 25 ft. in length and are so designed that the skip is offset 10 in. from its center position as it descends to the bottom. The extension rails take the wheels of the skip.

Drilling was started at 7:30 a.m. on the first shift and was usually completed at 1 p.m., the drillers leaving for their lunch as soon as they had completed their respective sections. On completion of drilling, the drills, drill steel and other impedimenta were removed from the shaft bottom, the extension rails raised and holes charged and tamped. Firing lines were laid and the charges connected in parallel. The bulkhead was then blocked and the charges fired. This was usually accomplished by 2:30 p.m. An interval of forty-five minutes was allowed for exhausting and blowing out smoke. The mucking crew cleaned down timbers and replaced extension rails. Mucking followed upon the second and third shifts. A mucking crew of four men worked upon each shift. Two timbermen worked on the morning and two upon the afternoon shift. Placement of timbers was done as conditions permitted. When the cycle of operations was interfered with, the drilling crew was called out upon the afternoon shift or, where this was impracticable, the necessary work for the completion of the shaft, such as the installation of guides, rails, electric power, and bell lines, was done.

PUMPING PROBLEM NOT SERIOUS

An extra heavy 9-in. water column was carried down with the shaft. A small compressed-air sinking pump was attached to the extension rails and used for drainage. An ejector was also used when sufficient water pressure was available. Pump stations were cut in at the 1,000 and 1,650-ft. points and equipped with small motor-driven triplex pumps. Water handling was a minor problem. Where possible water was removed by bailing with the skip, buckets being used to fill the skips. The last named proved to be the cheapest method, but its application was necessarily limited to relatively small amounts of water.

For signaling, electric bells controlled by pull switches were used. One switch was put in at the top of the shaft and another at the 1,000-ft. point. A counterbalanced pull wire connected with the switch and served for operating it. An armored power cable supplied current for the pumps and for lighting.

No accidents occurred, except those of a minor nature. The interesting features of the job were the hardness of the rock and the heavy blasting required. The bulkhead functioned satisfactorily and was an important feature in the success of the work. There was no interference with mine or mill operation during the work of shaft construction. Connection between the two sections of vertical shaft was accomplished without a shutdown of the mill.

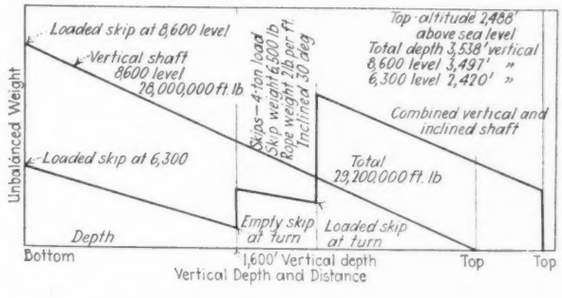

Loaded skip at 8,600 level
Vertical shaft 8600 level 26,000,000 ft. lb
Skips—4-ton load Skip weight 6,500 lb Rope weight 2 lb per ft. Inclined 30 deg
Top altitude 2,488' above sea level
Total depth 3,538' vertical
8,600 level 3,497' "
6,300 level 2,420' "
Combined vertical and inclined shaft
Loaded skip at 6,300
Total 23,200,000 ft. lb
Unbalanced Weight
Depth
Empty skip at turn
Loaded skip at turn
Bottom
1,600' Vertical depth
Top
Top
Vertical Depth and Distance

Fig. 8—Graphic comparison showing energy required for hoisting by the old and new methods

The layout of the 8,600 station of the new shaft is shown in Fig. 6. The shaft timbering is shown in Fig. 7. It is of interest to note that the change from hoisting in the combined vertical-incline shaft to hoisting in a vertical shaft resulted in an appreciable power saving, as shown in Fig. 8, which is a general diagram indicating the foot-pounds of work under both conditions, friction not being included. By the old arrangement two additional accelerations, from 200 ft. per minute, the maximum rate at which the turn could be negotiated, to 1,200 ft. per minute, the working speed of the hoist, were required. Hoisting from the vertical shaft is 1,000 ft. deeper. In the diagram no consideration was given to the additional hoisting necessary in the auxiliary slope from the 6,300 level.

As "The Reef" Sees the American Tourist

The following interesting commentary on the American globe trotter is taken from *The Reef*, of Johannesburg:

"Open to an American tourist's eyes the most enchanting piece of scenery; he will take a tighter grip of his cigar and rasp out, "Now, I'll say that's real fine. Where do we go next?' Show him over the most interesting of towns, and you will never be able to wean his interest away from the frenzied rush of seeing everything in the shortest possible time. But just bring him within earshot of the reverberating roar of a gold-mine battery, and you check him in his stride—the automaton becomes human and as eager as a schoolboy at his first pantomime. In his relentless race of sightseeing, your tourist is suddenly confronted by an organization which produces a vital substance in his life. The association between gold and his almighty dollar attracts and holds his interest. Mention the word 'gold' and you achieve the apparently impossible — you win from him all thought of his time table.

"It was my privilege to accompany a party of these inveterate globe trotters who had answered the tourist agencies' call to 'see this world before the next,' and I was interested to know what effect a Johannesburg gold mine would have upon them. They left the hotel and entered the waiting cars with the usual air of indifference.

"'Say, where do we go now?' asked a retired builder from Pittsburgh, ignoring the program which he held in his hand. He was again told and the procession started.

"The Main Reef road provided that element of unpleasantness which can so easily put an American tourist in a bad mood. The day was fine, but there had been no rain and the string of cars stirred up the dust. I quaked in apprehension—and the storm fell! 'It's time you guys out here learned to put oil on your roads,' growled a voice from the rear of the car. 'If I'd known I was going to be prematurely buried, I'd have stayed back at a movie show,' rasped a foghorn at my side.

"At last the cars drew up before the mine office and, with such speed as is dear to the heart of an American on tour, we were ushered into an inner sanctum. Here a reception awaited us which dispelled all thoughts of the Main Reef road and completely insured the success of the visit. Tea and cakes were spread out invitingly upon the office tables. There were solicitous officials to attend to their wants and, above all, to answer their questions. Now, if there is any one thing which these tourists love above another it is to be fussed over in this way.

"Ten minutes later the invasion of the surface workings commenced. The removal of the crucibles from the furnace kept them interested, but it was not until the crust of slag had broken away and the gold exposed that their enthusiasm was really aroused. They could hardly wait until the small cone of gold had cooled off; and each one had to hold it in turn. Questions oozed from each sightseer, and even the hum of the adjacent machinery was drowned by the distinctive nasal twang. Figures were demanded and, furthermore, had to be expressed in terms of dollars. The deluge of questions betokened their interest all along our route, past the mill, the tables, the cyanide tanks, and the sorting plant. For some of them the worst few minutes of the tour must have been those spent in the battery, for there even the powerful voice of a retired auctioneer was of no avail.

"In their uncontrollable enthusiasm to see everything that is to be seen, they finally went below. It is typical of their thoroughness that, by the time they had completed their inspection, they were tolerably conversant with the process, facts, and figures of the gold industry. Their big disappointment was the comparatively small size of the bricks of gold which represented the sole output of this mighty concern. 'Why,' remarked a manufacturer from Kentucky, 'with this 'mount of labor and machinery yew c'd make a durn sight more out of packin' beef and making underclothes.' 'Who then would produce the gold?' I ventured. 'Aw, leave that for the muts to do,' he replied, as he spat out the unrecognizable remains of his cigar.

"But he was visibly impressed.

"So we're the 'muts.'

"When all is said and done the operations of a gold mine are very much akin to their own commercial enterprises—the only difference being the subject from which the gold is extorted—just the difference between solid rock and a solid community."

Cuba a Vast Storehouse of Iron Ore

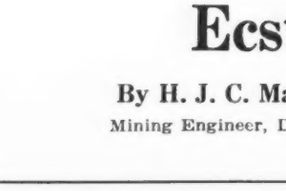
Cuba is tenth among the countries of the world from the standpoint of its iron-ore resources, says *Commerce Monthly*, its known deposits being reckoned at more than 3,000,000,000 tons of available ore, representing over 1,000,000,000 tons of metallic iron. Cuban ores are largely American-owned, and have been imported into the United States for thirty-five years. It is likely that most of the supply eventually will be smelted in this country, since, so far as is known, there is no coal of importance in Cuba. At present, however, United States takings are not heavy.

Copper and manganese are also mined in Cuba, but though exports of the ores of these metals are of some importance, there is no present likelihood of their playing an important part in the balance of Cuban trade. Chrome ores are known to exist in considerable quantities, and gold, silver, lead, and mercury have been reported, but commercially speaking nothing has come of them. There are seepages of petroleum, and asphalt is found both in liquid and solid form. Drilling for oil thus far, however, has not met with much success, and Cuban asphalt is suitable only for roofing.

Ecstall: A Mine of the Future?

By H. J. C. MacDonald
Mining Engineer, Denver, Colo.

The Optimist Sees Great Possibilities in the Mineral Resources of Western Canada



H. J. C. MacDonald

AS WE LEAVE Vancouver harbor, tugs overhung by black smoke are towing logs to near-by sawmills; as we voyage on up along the coast, we skirt a snow-topped Coast Range so thickly timbered that a mineral prospect finds breathing space only at tidewater or at timber line, and the first docking of our steamer is at a pulp mill busy grinding up the coast forests into newsprint. Saw and pulp mills may have little to do with mining, but on the coast of British Columbia the twin industries are nibbling away at one edge of what will ever be the great problem of Canada's mineral industry—namely, a vegetation and a forestation so thick and so widespread that it blankets the likely prospecting areas from the boundary to the Arctic and from the Atlantic to the Pacific.

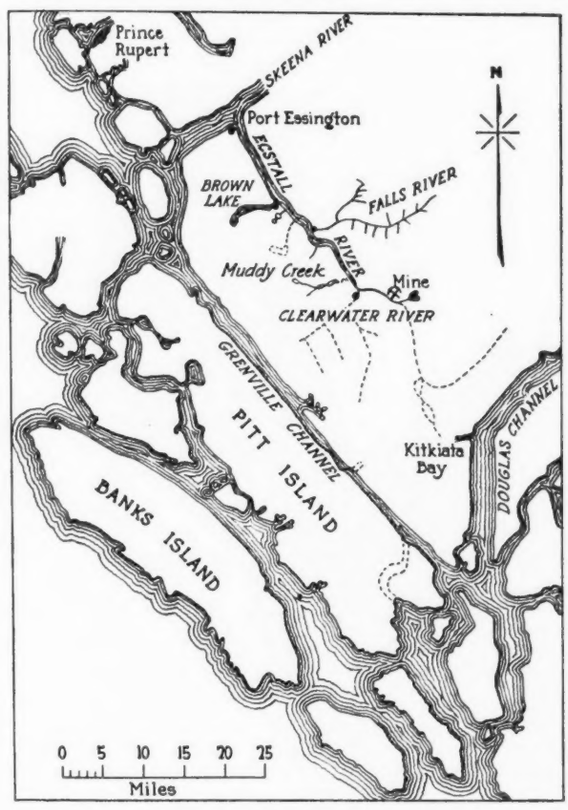
To the old prospector sure to be clinging to the rail of a northbound steamer, the core of the Coast Range, hidden beneath the partly cut timber and the almost tropical undergrowth of a region of profuse rainfall, is just a granite so "hungry" that many a tenderfoot has sat down on it and eaten up his grubstake! To the geologist who leans over the rail beside this old coast barnacle, the core of the Coast Range was formed by a series of intrusions of upper Jurassic to middle Cretaceous granodiorite to gabbro that welled up into the older Paleozoic formations, and this rocky mass is now the Coast Batholith, a geologic colossus that stretches along the Pacific for over a thousand miles from Washington State to Alaska.

After the prospector had broken many a pick in futile prospecting, the geologist, inferring a genetic connection between the batholith and the majority of the ore deposits of this coast, came to his rescue and advised him to prospect the older formations along the east and west margins of the granite, or to choose as lucky, amidst the glacier rounded mountains of granite, the straggling mountains of schist that here and there saw the sky with sharp, serrated peaks.

In his free and easy manner the prospector calls these areas of schist landlocked in the granite "schist islands." His friend the geologist, with the greater wisdom accredited to him, terms them the "roof pendants" of Daly, and thinks of them as the immense falls of roof caused by a liquid magma understoping the overlying formations. But to the laity they are just windfalls to this coast, for two of them, now tapped by long inlets, have given it the two largest copper mines in the British Empire—Hidden Creek and Britannia.

At this crucial moment an optimist elbows in between the prospector and the geologist to assert that all the real mines hereabouts are on, or close to, tidewater, where the country all but tumbles into a prospector's boat. The pessimist—there is always one on board—now makes the unasked-for prediction that no more mines will be found in this locality, at the same time pointing out the hundreds of arms of the sea that everywhere grope into the coast line and invesigate with their long fingers all but the interior margin of the batholith. The geologist sees a little truth in this, but both the optimist and the prospector mutter angrily that new mines are found only by hope, faith, and hard scratching.

Fifteen miles below Prince Rupert is the Skeena River; from it the Ecstall winds about in a broad, flat, well-timbered, mountain-bordered valley, into which, with unshackled water-power, side streams drop hundreds of feet out of hanging valleys—a river so industrious through the ages that it has all but sliced off a segment of the Coast Range for a huge island, a triplet to the bouncing twins, already arrived to the seaward, Banks and Pitt islands. And withal a fine



Map of Ecstall region

river for an optimist, for tidewater flows far into it and irons out, twice daily, 35 miles of its meandering waterway. So the prospector floats up river on the crest of an inflowing tide.

Seventeen miles up the Ecstall the granite gives way to schistose rocks, mainly argillaceous, siliceous, and calcareous sediments, with some igneous members, beds now tilted vertically and metamorphosed into quartz,

mica, and hornblende schists, slates, and occasional limestones.

The prospector, finding himself in a "schist island," begins to show interest in something besides his tobacco. Thereupon he sights three long and narrow mineralized zones where the rock looks "soft" to him, three red sashes flung across the mountains and unfurling cross country the colors of "good prospecting." The middle one shining out in the sunlight is the strongest and the most likely.

Thirty miles up the Ecstall, red waters flow in from the north. Taking the hint, the prospector lands, and follows this side stream across the broad river flat, noting along the way the iron-oxide coated boulders in its bed. The stream leads him into a canyon, for Red Gulch, as it is called, an exception among Ecstall tributaries, has sawn itself a notch several hundred feet deep in the mineralized schist of the river valley wall. In this canyon the prospector finds the lower portions of rock slides cemented into iron conglomerates. In its bottom are large outcrops of steel-gray, fine-grained pyrites, clean swept by a vigorous water erosion. All around iron oxide clings to shelves on the canyon walls, an iron gossan used by the coast Indians for war paint ages before the white man subdued them with a bottle.

Comparison with Bonanza and Hidden Creek

The prospector inspects these outcrops dubiously; they show so little copper. Yet he expects pyritic deposits in this region to have copper-barren outcrops unless water leached from a neighboring body trickles over them and re-deposits on their surface; as was the case at the Bonanza mine, on Granby Bay, where, for years, futile tunnels were driven into some low-lying husks of pyrite, copper plated by water from the real orebody, hidden under a camouflage of barren pyrites, high up above them on a cliff. The old prospector is aware of all this, yet an early, well-known but pessimistic geologist, on examining the then prospects of Granby Bay—Bonanza and Hidden Creek—noted the prevalence of copper plating and condemned the entire British Columbia coast as a unique land of "superficial enrichments."

At this point the old prospector reassures himself as to the presence of copper in the Ecstall bodies by copper-coating a blade of his jackknife in a rill of water that drips down a sheer wall of rock.

For 2,000 ft. Red Gulch canyon cuts a passage along—in fact it was created by—two elongated, overlapping lenses of pyrites dipping 80 deg. east and striking north and south with the schists. The first lens in the canyon is the South Lens, a narrow, veinlike body 25 ft. wide and 1,750 ft. long, with extremely tapering and pointed ends. Erosion has eaten away its pyritic outcrop faster than the inclosing schists, and so has formed near its northern end a waterfall 120 ft. high. Climbing up beside this waterfall brings one to the broader outcrops of the second lens, the North Lens, an egg-shaped body 150 by 1,000 ft., the larger of the pair.

As a matter of fact, the North Lens is a sizable mineral body, comparable to the No. 1 orebody at the Hidden Creek mine, to the Burra Burra orebody of the Tennessee Copper Co., and to the orebody at the Mount Lyell mine, in Tasmania. The last named it also resembles in composition.

No dikes cut these lenses; waste inclusions are rare, their dimensions trivial. A drill hole driven into the North Lens in my diamond-drill campaign of 1918 and 1919 (Hole 28) had 2 ft. of waste in a sulphide length of 752 ft.—a ratio that is not abnormal. Inclusions, when they do occur, are the ruptured and metamorphosed fragments of ribbon quartz veins, or small slabs of schist that have a schistosity parallel to the nearest wall, although the sulphides themselves never show a traceable striation. Mineralogically these two lenses are essentially admixtures of pyrite, chalcopyrite, sphalerite, and quartz. But numerous other minerals creep in by way of the schist inclusions.

Post-mineral faulting is not in evidence, or has been hidden by the intensity of the regional metamorphism.

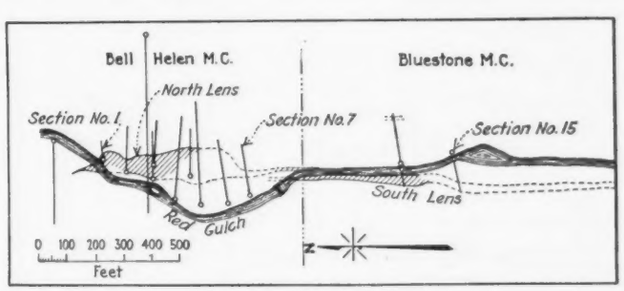
Contact Between Schist and Sulphides

The schist walls are in abrupt contact with the sulphides, a few feet of silicified schist in which the black mica is altered to white mica being typical of the contact. This is a characteristic solely of the foot and the hanging walls—that is, the sides of the main bodies, as the extremely tapering ends of the lenses show a gradation for hundreds of feet along the strike. The solid sulphides merge into a well-mineralized muscovite schist, which, in turn, merges into the typical, slightly altered, sparingly mineralized, biotite schist. The chalcopyrite, however, does not follow out these slender, pointed ends, but terminates abruptly near the end of the massive sulphide body, after which the decreasing mineralization is entirely a matter of pyritization.

In addition to the biotite and the muscovite schists, a hornblende schist occurs; an amphibolite with long prisms of black hornblende, arranged, to the partial or complete destruction of the fissile character of the rock, not on the planes of schistosity but as radial interlacements of rods in its fine green groundmass. Under the microscope this schist proves to be the product of an original diorite.

Sediments Intruded by Dikes and Sills

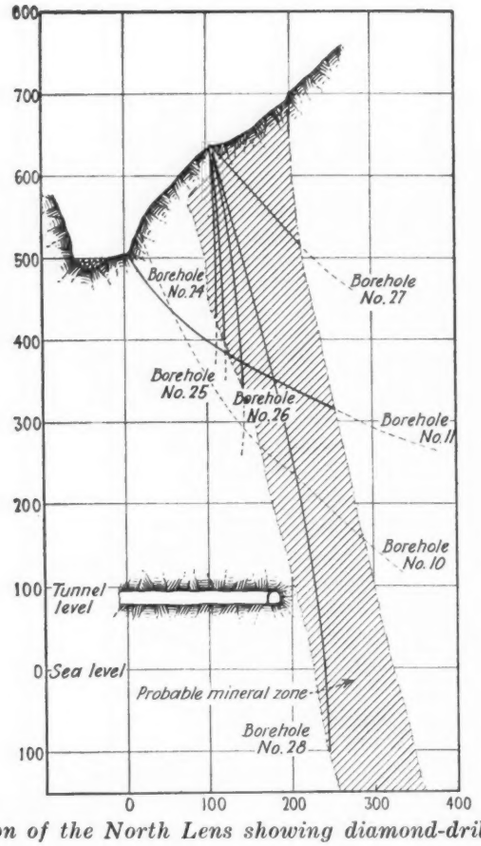
The structural relations show sedimentary beds, mainly shales and sandstones, intruded by a series of diorite dikes and sills, the mineralization being due to this intrusive diorite, apparently an early phase of the batholitic magma. The freedom of these lenses from inclusions, and the veinlike form of the South Lens, is



Plan of mineralized zone at the Ecstall property

the expression, not of the original replacement of a sheeted zone—replacement being a minor phenomenon here—but of the filling of open fissures by fluid or semi-fluid mineral solutions to create orebodies that were later tilted, squeezed out, and baked by the intense regional metamorphism consequent upon the intrusion of the Coast Batholith into the present elongated lenses of pure recrystallized pyrites, orientated in conformity with the inclosing beds of foliated schists.

The individuality of the Ecstall bodies is that small, all-of-a-size grains of iron pyrite make up 92 per cent



Section of the North Lens showing diamond-drill holes

of their mass, and the remaining 8 per cent, the contents of the interstices in the pyrites, is composed of the chalcopyrite, sphalerite, and minor minerals, a relationship shown by screening, after lightly crushing, a sample of these sulphides, when the coarse pyrites caught in 10-mesh assay $7.70 a ton copper, zinc, gold, and silver, and the fines through 200 mesh, $33.28 a ton.

The notable metallic purity is manifest in the following weighted analysis of the sulphide cores taken from the North Lens:

Element	Content	Per Cent
Copper	0.86	
Zinc	2.20	3.33
Lead	0.20	
Arsenic	0.07	
Antimony	tr.	
Silica	2.13	
Alumina	1.09	
Lime	0.45	4.72
Magnesia	0.35	
Barium	0.70	
Iron	42.75	92.10
Sulphur	49.35	
Total	100.15	

In this analysis the Ecstall deposit is closely comparable with the pyritic deposits of Kyshtim, Russia[1]; and in that it can be classed as a large pyritic deposit, the Ecstall also resembles Hidden Creek, 100 miles to the north, and Britannia, 500 miles to the south. It may be compared to the Shasta County, Calif., deposits, still further south. The Balaklala analysis is closely similar when its ten times higher silica (21.4 per cent for Balaklala to 2.1 per cent for Ecstall) is allowed for; and the Hornet mine of the Mountain Copper Co., which feeds the sulphuric acid works on San Francisco Bay, has an identical sulphur content: 47 to 50 per cent. The parallelism along the Pacific slope of five major mineral occurrences of a strongly pyritic nature can occasion some generalization, as it suggests that emanations from the magma of the Coast Batholith, surcharged with iron and sulphur, may link them in a common genetic bond.

[1]A. W. Stickney: "The Pyritic Deposits of Kyshtim, Russia." *Economic Geology*, Vol. X, p. 600.

Details of Diamond-Drill Procedure

In the drilling practice, both 5-ft. core and 5-ft. cutting samples were taken. The cuttings are an ever-present check on the core, the average agreement between the two being within 0.14 per cent copper. The core was transferred from the drillers' boxes into scaled weighing boxes, and the length and the weight of core recovered was recorded. Recovery was 64.5 per cent by length. The weight gave an average of 7.8 cu.ft. of sulphides to the ton, a useful determination in the estimation of tonnage, as it tends to add natural fractures to the interstitial porosity. The core was split longitudinally on an iron wedge, a continuous half filed away in drawer trays for permanent reference, the other half crushed, pulverized, and assayed for copper by both the cyanide and the permanganate methods, and also check assayed for zinc and precious metals, and later analyzed.

Two sound rules for all exploratory drilling were exemplified by the work:

1. Every bore hole should be surveyed. The mica schist was ribbed at times by hard quartz layers, yet the local deviation of drill holes was so extreme as to be eccentric. Short holes, 500 ft. in length or less, the more so if vertical, are commonly assumed not to deviate appreciably, yet in this deposit just such holes, as shown by holes 10 and 11, began to sidle in the first 100 ft. In the extreme case a nearly vertical hole (75 deg.) became nearly horizontal (30 deg.) at 600 ft.

Many a hole must have missed its target in the past, for a large amount of mineral exploration has been carried out by unsurveyed holes. And where a prospect has been rejected by a random and unsurveyed hole or two, the future can do some profitable re-checking. In every instance tonnage estimates based on unsurveyed holes are untrustworthy.

2. The utility of deflection wedges should not be overlooked. By sinking a deflection wedge in an Ecstall hole that ran out of the sulphides, and its usefulness, in depth, a branch was forced back into the orebody, and the stub so driven recovered an added length of informative core. By this means a number of stubs can be branched off from a single bore hole, and it is possible to re-sample an orebody as many times as is desirable. This is a pertinent proceeding with narrow veins or bodies in reaching which long lengths of waste drilling are required. Also, the dip of a formation can be read from a single surveyed bore hole and its surveyed stub.

Mountain orebodies do not exhibit their tonnages readily, as deep holes have to be fought for. About 600 ft., for instance, is the drilling limit for many ore deposits that dip into mountain sides. The Ecstall bodies were in a mountain, and the North Lens, which promised the greater tonnage, and on which the greater part of the drilling was done, was at the very bottom of a deep canyon that the lens carried on, in effect, into the depths of the earth. Deep side holes were impracticable, and so set-ups had to be made on, or close beside, its outcrop, and the lens followed down with nearly vertical holes. The most successful hole (No. 28) ran out of the sulphides at 752 ft., after having won nearly the same vertical depth.

Eventually the drilling developed the following tonnages:

Body	Tonnage	Copper Per Cent	Gold, Oz.	Silver, Oz.	Zinc, Per Cent
North Lens	3,843,475	0.86	0.02	0.74	2.2
South Lens	1,000,000	0.50	0.01	0.60	2.9
Total	4,843,475	0.79	0.02	0.71	2.3

Probably 2,000,000 tons more of this grade could be developed, and this could be augmented by the finding of new bodies *en echelon* in depth, a reasonable supposition in deposits of this type.

These tonnages, however—even though their bulk could be easily and cheaply mined through a 2,400 ft. tunnel 500 ft. below their outcrop—do not fulfill the economic requirements of a present-day mine establishment, their unavailability being due, in part, to the absence of enriched portions.

No Assurance of Inexhaustible Depth

Expectations of enrichment in depth must be held in check in a land of primary sulphides. Nevertheless, baptizing primary sulphides with inexhaustible depth, an eminent but this time optimistic mining engineer argued at length that Canadian orebodies, once found, can be trusted to go down indefinitely in undiminished size and richness. Unfortunately, an orebody can lose its corpulency underground in any land, and although it can be taken as normal in Canada that the glaciers have plowed off the richer crown of chalcocite, the present surface often planes through the frail roots of a secondary enrichment of chalcopyrite.[2] So even in the Northland, copper oreshoots in pyritic matrices tend to grow lean and to fray out in depth. For once an optimist went too far.

The enrichment of pyritic lenses such as the Ecstall can be conveniently forecast in a threefold division: (1) A difference in vertical richness, decreasing in depth; (2) a difference in horizontal richness, usually recorded in rich but narrow streaks along one or both walls; (3) erratic differences in richness, or sporadic plums of rich ore in the sulphides. Falling in the last division, a half million ton segregation at Hidden Creek gave 5 per cent copper against a normal of 2.2 per cent for the inclosing orebody, and a 850-ton plum at Mount Lyell yielded $525,000 net. The possible presence of enrichments, especially of the latter type, prescribes the close drilling of pyritic masses.

"Near" Ore in Two Deposits

In any case, a certain footage of drill holes, carefully apportioned, is indispensable to probe, obtain the true average, and so prove, one way or another, any mineral deposit. At Chino 420 tons of ore was developed for each foot drilled, at Ray 585 tons, at Inspiration 683 tons, and at Miami 742 tons, whereas in the primary sulphides of British Columbia the following ratios have been recorded: At the Phoenix mines, near the end of their life, 140 tons; at Canada Copper at the beginning of shipping, 85 tons; and at Hidden Creek, also at the beginning of shipping, 417 tons. In comparison with the above figures, at the end of the Ecstall exploration each foot of the 10,717 ft. drilled had explored 452 tons of sulphides.

Two near approaches to economic enrichment were found in the Ecstall deposit—a 30-ft. width of 1.9 per cent copper ore, carrying a dollar in gold and silver, along the footwall of the North Lens, a minable body of 600,000 tons which plays out in depth and which appears to be the tip-end of a secondary shoot of chalcopyrite; and a 5 ft. width of 3 to 5 per cent copper ore close to the hanging wall of the same lens, the usual readjustment of copper within a porous sulphide mass and against an impenetrable wall rock.

Barely perceptible enrichments or incipient secondary enrichments are: In the upper portions of the body, 25 to 50 ft. from the surface, gold is slightly increased in amount, and at the 100 and again at the 200 level there is an appreciable increase in zinc and silver.

As to the result of this drill campaign, it is surprising that in this modern day, so called, a deposit of the mineral purity of the Ecstall locks up the following bulk of metals:

Element	Pounds
Copper	76,501,000
Zinc	226,312,000
Lead	19,373,000
	Tons
Iron	2,034,600
Sulphur	2,331,100
	Ounces
Gold	86,870
Silver	3,444,200

And furthermore, at current prices, the per-ton value of the entire Ecstall tonnage, regardless of incidental revenue from the iron and sulphur, is, as shown below, in excess of the probable treatment costs and losses:

Copper	16 lb at	13c	=	$2.08
Zinc	46 lb. at	6.5c	=	2.99
Silver	0.7 oz. at	60c	=	0.42
Gold	0.02 oz. at	$20	=	0.40
Total per ton				$5.89

Falls in Red Gulch canyon near the Ecstall mine

[2] W. H. Emmons: Bulletin 529. U. S. Geological Survey.

Large mineral deposits are rare. One that has a metal value in excess of the probable extraction and treatment costs and losses is always a future probability, and should receive careful consideration; for not so many years ago not a few ill-directed mining corporations wrecked their futures when they passed by intrinsically great mineral deposits on account of their refractory ores—deposits that were, perhaps, too siliceous for ready smelting, but which have since paid out millions through flotation; or too "zincy," as was the Sullivan mine of the Consolidated Mining & Smelting Company of Canada, a deposit that now yields immense wealth to the electrolytic zinc process.

The Ecstall is an ideal problem for a metallurgist with vision and optimism, and not, by any means, an isolated one. To the few millions of tons in this deposit, many millions can be added by the mined-out shells of similar Western deposits—an immense aggregate tonnage that would be available by the economic recovery of the iron, for which there is, and ever will be, a growing market on the Pacific Coast; by the recovery of the sulphur in a crude, shipable form; or, in the case of the Ecstall and a few other deposits, by the economic recovery of the zinc. The vast and ever-growing tonnages of pyritic discards of this nature point to their possible utilization as a wise direction for metallurgical research.

LIMITED MARKET FOR PYRITE

In any case, the years, and the growing needs of industry, will reclaim Western pyritic deposits. As has been shown, the pulp mills now import across the Pacific crude sulphur from Japan, and take no notice of the Ecstall pyrites next door to them, although it equals in sulphur content the Rio Tinto pyrites shipped across the Atlantic from Huelva, Spain. But the Pacific pulp mill market for pyrites is not a large one—at present it would burn about 75 tons of Ecstall pyrites daily—and it is somewhat doubtful if this particular market will ever utilize the large tonnages at hand.

In the future production of acid phosphate fertilizers from natural phosphate rock is a more certain utilization of Western pyrites, but one that, although it has already consumed similar deposits on the Eastern seaboard, is a long way in the future on the Pacific, as it awaits the impoverishment of Western farm lands. Such a market, however, is the last resort of the Ecstall—if an enterprising metallurgist does not settle the problem sooner.

"Maybe it'll be a quarry, some far-off day, but it ain't a mine, and never will be," grumbles the pessimist, and, having a fine start, he rushes on, forgetful of the fast-growing mines of Rouyn, of that husky pair of giants incubating in the Hudson Bay wilderness, Flin Flon and Cold Lake, of the native copper of the Coppermine River peeking out from under the Arctic edge of Canada's blanket of vegetation, and of other deposits now so remote and so inaccessible that Canada herself may be forced into the kindness of willing a few of them to the coming generations. Heedless of all these far-flung deposits, the pessimist sums up, "What's more, there ain't another mine in Canada."

The optimist, however, will ever contend that a pessimist has not, and never will have, a useful place in mineral exploration, and ever persist in the blind belief that Canada, a vast and covered-up land, hides, even in this day of hard scratching, many mines to be.

Nipissing Mill Results

The Nipissing Mining Co., operating in the Cobalt district, in northern Ontario, is one of the oldest companies in the area. During 1926 costs of milling were higher than in previous years, and the grade of the ore was lower. However, the following data are of interest as revealing the costs under the conditions obtaining at Cobalt. The ore can be classed as refractory.

During 1926, according to the annual report, 84,555 tons of ore assaying 23.53 oz. silver per ton was milled to produce the following: 28 tons of precipitate assaying 24,465 oz.; 417 tons of coarse concentrate assaying 2.383 oz.; and 104 tons of fine concentrate assaying 832 oz. Costs based on 84,555 tons are as shown in the following table:

Low-Grade Mill Costs

	Total Cost	Cost per Ton
Crushing plant	$4,494.69	$0.053
Aërial tram	2,812.57	0.033
Surface tram	10,383.83	0.123
Crushing and elevating	10,682.70	0.126
Batteries	24,248.71	0.287
Tube mills and classifiers	41,594.62	0.492
Concentration	18,731.82	0.222
Cyanide treatment	86,266.54	1.020
Filtering and discharging	18,555.50	0.219
Clarifying and precipitation	15,598.61	0.184
Refining	8,252.11	0.098
Heating	18,159.27	0.215
Water service	3,442.68	0.041
Residue dam	2,344.75	0.028
Research	929.78	0.011
	$266,498.18	$3.152

This cost may be segregated on a per-ton basis as follows: labor, $0.950; supplies, $1.466; power, $0.595; shops, $0.193; and credits, $0.052.

The costs and consumption of chemicals and sundry supplies are shown in the following table:

Cost of Supplies at Low-Grade Mill

	Total Pounds	Cost per Pound	Total Cost	Pounds per Ton	Cost per Ton
Sodium cyanide	328,440	$0.1860	$61,090.23	3.884	$0.722
Lime	410,400	0.0074	3,021.55	4.854	0.036
Pebbles	258,396	0.0121	3,135.49	3.048	0.037
Sodium sulphide	76,252	0.0430	3,276.11	0.902	0.039
Caustic soda	29,260	0.0397	1,161.92	0.346	0.014
Iron balls, 1¼ in.	40,707	0.0378	1,542.50	0.481	0.018
Aluminum	5,854	0.2604	1,524.42	0.069	0.018
Hydrochloric acid	9,788	0.0330	322.78	0.116	0.004
Steam coal	2,475,200	0.0047	11,627.41	29.273	0.137
			$86,702.41		$1.025

The concentrates and precipitates are sent to the high-grade mill for final reduction to bullion. The following figures are based on a production of 1,940,597 oz. of silver and 84,555 tons of ore:

Cost of Producing Silver

		Per Ton Ore	Per Oz. Silver, Cents
Diamond drilling	$2,769.48	$0.033	0.143
Exploration	160,587.51	1.899	8.275
Development	172,308.02	2.038	8.879
Stoping	194,310.88	2.298	10.013
Assaying and engineering	13,573.21	0.160	0.699
Residue and dumps	8,019.10	0.095	0.413
Administration and office	43,026.81	0.509	2.217
Camp maintenance	15,706.18	0.186	0.809
Insurance and taxes	46,011.39	0.544	2.371
General and legal	12,939.48	0.153	0.667
High-grade mill	47,762.22	0.565	2.461
Low-grade mill	266,498.18	3.152	13.733
Marketing product	6,474.66	0.076	0.334
Corporation, New York office and traveling	21,991.80	0.260	1.133
	$1,011,978.92	$11.968	52.147
Less rent, exchange and miscellaneous income	13,045.96	0.154	0.672
Total cost of production	$998,932.96	$11.814	51.475

Discussion

Determining Dip and Strike Graphically

THE EDITOR:

Sir—On reviewing the back numbers of the *Engineering and Mining Journal*, I read with interest the graphical solutions of the "strike and dip" problem suggested by Mr. Kemnitzer in the Dec. 26, 1925, issue and by Prof. Theodore Simons in the Jan. 30, 1926, issue.

May I submit a simple solution for not only the "dip and strike" but, also, for the thickness, outcrop, and various other phases of the vein problem in a clear and simple manner by a method that can be easily visualized.

For convenience in solution let us use co-ordinate paper of any desired scale. Three views are necessary: an elevation (front view), a top view (plat or map showing location of points as located to scale in the field), and an auxiliary view (edge view of the vein in the direction of the strike of the vein) The subscript letters F, T and A indicate the front, top, and auxiliary views respectively. All measurements for elevations are measured from the horizontal plane (*H.P.*) through *A* in both the front and the auxiliary views.

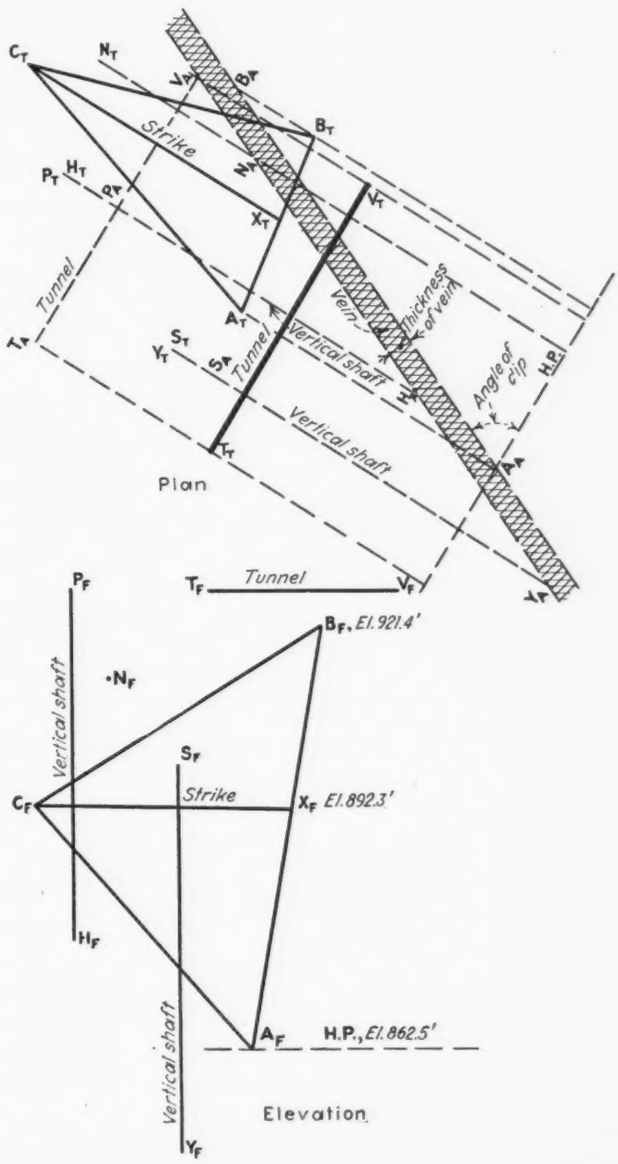
1. Solution for strike—Plat the points *A* (El. 862.5′), *B* (El. 921.4′), and *C* (El. 892.3′) to some convenient scale as indicated in the accompanying diagram. Connect *ABC* in both front and top views. Draw the horizontal line (the strike) $C_F X_F$ in the plane of the front view of the vein intersecting $A_F B_F$ at X_F. X_T is found on $A_T B_T$ in the top view vertically above X_F. Draw $C_T X_T$ the required direction of the strike (the trend of the vein).

2. Solution for dip—Take an edge view of the vein in the direction of the strike. The true size of the angle of dip can now be observed and measured. At any convenient distance from A_T in a direction parallel to the strike locate A_A (the auxiliary view of the point *A*) and draw the horizontal plane (*H.P.*) through A_A at right angles to the strike (a ray through the strike). Draw a ray through B_T parallel to the strike and locate B_A on this ray the same distance above the auxiliary *H.P.* that B_F is above the front view *H.P.* through A_F. A line drawn through $A_A B_A$ represents the edge view of the vein, and it crosses the auxiliary *H.P.*, giving the required angle of dip.

3. Solution for thickness of vein—Suppose that points *A*, *B*, *C* were points in the footwall and that *N* was a point in the hanging wall. Through N_T draw a ray parallel to the strike and measure up on this ray a distance above the auxiliary *H.P.*, a distance equal to that of N_F above the *H.P.* through A_F in the front view and locate N_A. Through this auxiliary point N_A draw a line parallel to the auxiliary line $A_A B_A$, thereby locating the hanging wall and giving the thickness of the vein (edge view of the vein).

4. Solution for depth of vertical shaft—From *S* it is proposed to sink a vertical shaft to cut the vein. Through S_T draw a ray parallel to the strike, and on this ray locate S_A above the auxiliary *H.P.* a distance equal to that of S_F in the front view above the *H.P.* through A_F. The distance from S_A to the point where the ray intersects the vein Y_A is the depth of the proposed vertical shaft. Lay this depth off vertically below S_F to locate Y_F, the bottom of the shaft in the front view.

5. Suppose another vertical shaft is to be sunk from



a point, *P*, on the surface to cut the vein. It is solved in the same manner as that described under problem 4. H_F, the bottom of the shaft, is above the *H.P.* in the front view a distance equal to the distance that the intersection of the shaft with the vein is above the auxiliary *H.P.*

6. Suppose a proposed horizontal tunnel is to be driven from the point *T* to the nearest point in the vein. Solution: Through T_T draw a ray parallel to the strike and locate T_A on this ray a distance above the auxiliary

H.P. equal to the distance that T_F is above the *H.P.* through A_F in the front view. A horizontal line through T_A drawn parallel to the auxiliary *H.P.* and intersecting the auxiliary view of the vein at V_A is the required length of the tunnel. Through V_A draw a ray parallel to the strike and through T_T draw a line perpendicular to this ray intersecting it at V_T. T_TV_T gives the bearing of the tunnel and locates the point on the map where the tunnel intersects the vein, and the point to sink a vertical air shaft to connect with the tunnel at the intersection of the vein. The front view of the tunnel is easily found, since it is a horizontal tunnel.

7. *Visualization*—The strike of the top view (plan or map) and the edge view in the auxiliary view of the vein show that this vein dips to the southwest and that its strike is northwest. By placing a 45-deg. triangle squarely in front of you with its longest edge resting on a table you may proceed to visualize the vein together with all of the conditions involved in the various problems above. Shove the left end of the triangle from you until the line of contact of the triangle and table corresponds in direction with the strike in the top view. Next, push the top of the triangle from you (backward) until an edge view of the triangle from the right end corresponds to the angle of dip in the auxiliary view, thus showing the dihedral angle between the triangle and the table. The triangle now occupies a position corresponding to that of the vein. All problems discussed should now be easily visualized.

RICHARD L. GRIDER,
Associate Professor of Mining Engineering,
Lawrence, Kansas. University of Kansas.

Bisbee Geology

THE EDITOR:

Sir—The article by J. B. Tenney, entitled "The Bisbee Mining District," in your May 21 issue marks a great step in the knowledge of a great mining camp.

Mr. Tenney states in the introductory paragraph that, "The object of this paper is to weigh the evidence, to determine whether the camp has reached its zenith or is to hold its present position." In the last paragraph he predicts the probable future extension of the district to the eastward. This is of great economic importance and of primary interest to those who are directly interested in the Bisbee district. As Mr. Tenney points out, this extension has already reached the Campbell shaft, and the prospecting of country beyond by shafts is already under way.

Aside from the question of the development of the district, this theory has great importance from a technical standpoint. Its full significance may not be appreciated immediately by geologists who are not familiar with Bisbee, and it should be emphasized.

Bisbee ranks third or fourth among American copper districts from the standpoint both of copper produced and profits. It has been a producer of the first rank for forty years. Its geology was first worked out in detail in 1904, since which date a great amount of further geological work has been done, and much has been written on the subject; all of which, as far as the economic phase is concerned, has been based upon a wrong assumption as to the prime consideration, the age of the great ore deposition. It is not until twenty-three years of geological work has been done that this most fundamental error has been corrected.

And what was this old assumption based on, and why this error? Stated in a few words it was assumed, first, that where the Lower Cretaceous conglomerate is in contact with quartz porphyry it is a sedimentary contact. The evidence, however, is that the intrusion of the porphyry was later than the conglomerate deposition rather than earlier, and that the conglomerate acted as a barrier to the porphyry. In rare instances porphyry dikes cut the conglomerate.

Secondly, it was assumed, as a corollary of the above-cited erroneous assumption, that the ore deposition, which immediately followed the intrusion of the porphyry, was also Pre-Cretaceous. A corroboration of this erroneous theory was the fact that the limestone replacement deposits end rather abruptly on contact with conglomerate. The fact that the mineralization penetrated the conglomerate, even though only to a relatively slight extent, was also overlooked. The very compact conglomerate, as now proves to be the case, acted as a barrier to the mineralizing solutions. This circumstance of mineralization ending abruptly upon encountering an unfavorable formation is, of course, quite familiar to geologists throughout the world, and this theory is reasonable and only unique as applied to Bisbee.

Mr. Tenney is to be complimented upon his temerity, in the face of the great amount written on Bisbee geology, for clearing up this error; and for the incontestible evidence he has offered that "the major age of mineralization was late Cretaceous or early Tertiary, conforming to the age in all the surrounding camps" (and it might be added conforming to the multitude of other districts throughout the Rocky-Andes mountain belt), and not Pre-Cretaceous, as heretofore has been assumed.

Once more the more natural supposition has replaced a false assumption based on evidence little investigated, and we find a district falling in line with its neighbors. Bisbee becomes "Tertiary" and is no longer a freak in respect to the age of its ore deposition.

Bloomfield, N. J. JAMES M. LITTLE.

Another Story of El Dorado

THE EDITOR:

Sir—Upon reading the interesting article by T. A. Rickard, on "The Myth of Eldorado," in the April 23 number, I was surprised to see that he omitted to mention one of the most delightful accounts of a visit to this fabulous country. In Voltaire's "Candide" the story is told of how Candide and his valet, Cacambo, reached El Pays d'Eldorado by being carried down a rapid river impossible to ascend, of what they found there, and of how they escaped over the precipitous mountains 10,000 ft. high which completely surround the country.

JAMES H. C. MARTENS.
Ithaca, N. Y.

Angles and Angels and Gold by the Quart

THE EDITOR:

Sir—I have recently had occasion to review a mining report in which I learned that two veins met at an acute "angel"; such a conception of the heavenly messenger is at variance with that given us by the late lamented Messrs. Raphael and Rubens. It certainly does not present nearly so attractive a prospect as another ore occurrence in which the gold occurs in "quarts," presumably pre-war and bottled in bond—and lease.

W. MURRAY SANDERS.
New York.

Consultation

Requirements of Annual Assessment Work on Mining Claims Explained

Numerous questions have been asked by readers as to assessment work requirements. Those that are most pertinent to a clear understanding of the matter have been selected and are answered in the following, with the aid of a competent legal authority. Queries most commonly received deal with the act of Aug. 24, 1921, which changed the period for doing annual assessment work on unpatented mineral claims from the calendar year to the fiscal year beginning July 1 each year. The text of this amendment is quoted in the following as a preliminary to the discussion.

"Sec. 2. That Section 2324 of the Revised Statutes of the United States be amended by adding the following words: '*Provided*, That the period within which the work required to be done annually on all unpatented mineral claims located since May 10, 1872, including such claims in the Territory of Alaska shall commence at 12 o'clock meridian on the first day of July succeeding the date of location of such claim: *Provided further*, That on all such valid existing claims the annual period ending Dec. 31, 1921, shall continue to 12 o'clock meridian July 1, 1922.'"

The questions, which involve points that appear to puzzle many claim holders, and the corresponding answers, are as follows:

"1. Is it true that the amendment of Aug. 24, 1921 (quoted above), pertains to all claims, whether lode or placer?"

The act of Aug. 24, 1921, applies to all mining claims, including placer claims in Alaska. This enactment merely changed the time for performing assessment work from the calendar year to the fiscal year.

"2. If a claim, whether lode or placer, were located on July 2, 1926, it is true, is it not, that the first year's assessment work must be performed by 12 o'clock noon, July 1, 1928?"

The first year's assessment work must be performed by noon, July 1, 1928, as stated.

"3. If placer claims in Alaska are affected by the amendment of Aug. 24, 1921, is it therefore true that the year within which annual assessment work on placer claims in Alaska must be performed is the fiscal year and not the calendar year?"

Placer claims in Alaska are affected by the amendment of Aug. 24, 1921, as stated in the answer to question 1. However, this enactment did not repeal the law of Aug. 1, 1912 (37 Stat., 242), which provides that on every placer claim located in Alaska not less than $100 worth of labor should be performed or improvements made "during each year, including the year of location, for each and every twenty acres or excess fraction thereof." Examples: (a) If a placer claim in Alaska were located on May 1, 1926, the locator would be required to perform $100 worth of assessment work on or before July 1, 1926. (b) If a placer claim were located, say, Sept. 1, 1926, the locator would have until July 1, 1927, to perform his assessment work. In other words, the provision of the act of Aug. 1, 1912, to the effect that $100 worth of work must be performed on placer claims located in Alaska "during each year, including the year of location," is still in force and was not in any way affected by the enactment of Aug. 24, 1921, which merely changed the assessment year from the calendar to the fiscal year.

"4. If the annual assessment work on a claim located several years ago in the United States or Alaska is not completed for the current year by July 1, noon, 1927, but is started before July 1, noon, 1927, and is in progress at noon on that day and is continued to completion after noon on that day, will the claim be open to relocation as soon as July 1, noon, 1927, has passed?"

To answer this question clearly it will be necessary to divide it into two parts; i.e., (a) mining claims in Alaska; and (b) mining claims in the United States. This is necessary because mining claims in Alaska are located under the act of March 2, 1907, and those in the United States are held under Section 2324 of the Revised Statutes.

As to (a) Mining claims in Alaska—Attention is invited to the act of March 2, 1907 (34 Stat., 1243), which amended the laws governing labor or improvements on mining claims in Alaska and especially provided that upon failure of the owner of any claim to comply with the provisions of the act as to the performance of work and improvements "such claim shall become forfeited and open to location by others as if no location of the same had ever been made." Under this legislation the courts have held that an owner in default cannot save his claim by the resumption of work prior to a relocation, the statute being in effect self-executing with respect to the forfeiture. The forfeiture provision of this act applies to all mining claims in Alaska, including placer claims. The act of Aug. 1, 1912, simply prescribed more stringent requirements with respect to annual work on placer claims. Answering the first part of the question specifically, I would say that the claim was open for relocation as soon as 12 o'clock noon, July 1, had passed.

As to (b) Mining claims in the United States—Such claims are located under Section 2324, Revised Statutes, and in general it may be said that the question with respect to the due performance of assessment work required thereunder is one which involves the right of possession between litigating claimants and the courts having jurisdiction. This statute, among other things, provides as follows:

"Upon a failure to comply with these conditions, the claim or mine upon which such failure occurs shall be open to relocation in the same manner as if no location of the same had ever been made; *provided, that the original locators, their heirs, assigns, or legal representatives, have not resumed work upon the claim after failure and before such location.*"

Under this provision a forfeiture does not ensue from the mere failure to comply with the law. It requires the intervention of a third party and a relocation on the ground before any forfeiture can arise. What constitutes a forfeiture is for the determination of the courts having jurisdiction and is not for the determination of the General Land Office. While there is a difference of opinion in the court decisions in the construction of that part of the statute italicized, yet the weight of authoritative opinion seems to be that resumption of work at any time prior to the lawful inception of an intervening right prevents forfeiture. (See Lindley on Mines, third edition, Vol. 2, secs. 651-654.). Under this situation, therefore, if the locator were in actual progress of performing assessment work in good faith before noon July 1, it would seem that his claim would be protected from relocation.

News of the Week

Summary

IN THE REORGANIZATION of the U. S. Bureau of Mines effective July 1, A. C. Fieldner, now in charge of the Pittsburgh station, will become "Chief Engineer of the Division of Experiment Stations," and, with his headquarters in Washington, will have charge of the work at all of the experiment stations of the Bureau.

Severe wind storms in the Mid-West damage the smelter of the Falcon Zinc Co., at Van Buren, Ark., and that of the Quinton Spelter Co, at Quinton, Okla. The Falcon plant is reported to be shut down for thirty days, and half of the Quinton smelter to be idle for sixty days.

The Carson Investment Co. proceeds with suits against the Phelps Dodge Corporation, Calumet & Arizona Mining Co., and the Anaconda Copper Mining Co.

More than seventy mines are reported to be idle in the Joplin-Miami district as a result of the low price of zinc concentrates; many miners lose employment and leave the district.

Placer gold is reported to have been found in three test shafts on the former military reservation along the Nome River at Nome, Alaska.

Transvaal Platinum, Ltd., of South Africa, is dissolved by the vote of the shareholders. The deficit of the company exceeds £25,000. The Grosvenor Bullion Syndicate, under the management of Theodore Pitcairn, will try to salvage the "Grosvenor," reported to have had £1,000,000 on board when wrecked in 1782. The mineral production of the Union of South Africa for March is valued at £5,263,739, establishing a new record monthly production value.

A consolidation of tin interests is reported in England. Interest in the Mount Isa option is again prominent in London on the arrival there of the Anglo-American Corporation's consulting engineer.

Weepah is now a normal prospect camp, with a slowly growing population of 600; Frank Horton appears to be chiefly responsible for the camp's conservative development.

A beneficial effect on the lead market is seen by lead producers in the announcement that the Monterey smelter of the Cia. Minerva de Peñoles, a subsidiary of the American Metal Co., is to be shut down for approximately six weeks.

Government Issues Potash Regulations

Prospecting Permit for Maximum of 2,560 Acres—Mining Lease Obtainable on Discovery of Potassium Within Two Years

THE GENERAL LAND OFFICE, Department of the Interior, has just issued regulations covering potash mining leases and prospecting permits under the act of Feb. 7, 1927, "to promote the mining of potash on the public domain." These regulations provide that a prospecting permit will be granted for not more than 2,560 acres of public lands and that as a reward for discovery of potassium thereon within two years, the permittee will be issued a mining lease.

A portion of the text of the regulations concerning prospecting permits follows:

"The act of Congress approved Feb. 7, 1927, entitled 'An act to promote the mining of potash on the public domain' (Public, No. 579), authorizes the Secretary of the Interior, under such rules and regulations as he may prescribe, to issue prospecting permits, for a period not to exceed two years, for the exploration of the land described therein for potassium in any of the forms named in said act, and under authority thereof the following rules and regulations will govern the issuance of such permits:

"Permits may be issued to (a) citizens of the United States, (b) an association of such citizens, (c) or a corporation organized under the laws of any state or territory thereof.

"A permit may be issued for not more than 2,560 acres of public lands of the United States in reasonably compact form, by legal subdivisions if surveyed; if unsurveyed, by metes and bounds description. The permit will confer upon the recipient the exclusive right to prospect for chlorides, sulphates, carbonates, borates, silicates, or nitrates of potassium on the lands embraced therein. In the exercise of this right the permittee shall be authorized to remove from the premises only such material as may be necessary to experimental work and the demonstration of the existence of such deposits or any of them in commercial quantities.

"A permittee who shows that he has made a discovery of valuable deposits of potassium within the area of the permit and within the two-year period for which issued, is entitled, under Section 2 of the act, to a lease of any or all of the land embraced in the permit containing such deposits and chiefly valuable therefor, the area to be taken in compact form. The lease will be issued at such royalty and acreage rental as may be fixed pursuant to Section 3 of the act. A discovery of a valuable deposit of potassium shall be construed as the discovery of a deposit which yields commercial potassium in commercial quantities.

"Under authority of Section 3 of the act, unless otherwise specified in the permit when issued, a permittee who makes the first discovery in any district and becomes entitled to a lease, will be granted a lease at the minimum royalty of 2 per cent of the quantity or gross value of the output of potassium compounds and other related products, except sodium, at the point of shipment to market, and at the mimimum rental of 25c. per acre, for twenty years succeeding the issue of the lease."

New Aluminum Works in Poland

A company has just been formed at Kattowitz, Poland, for the construction of an extensive aluminum factory with a capacity of from 2,400 to 3,000 tons per year. The raw material will be drawn from the aluminum ore deposits recently discovered in Upper Silesia. This ore contains over 25 per cent of pure aluminum. The capital of the company amounts to 15 million zloty, to which Swiss capitalists have contributed 5 million Swiss francs. The same Swiss capitalists are largely interested in Hungarian plants devoted to the production of aluminum products.

Carson Investment Company Proceeds With Suits

Depositions of witnesses in the case of the Carson Investment Co. versus the Phelps Dodge Corporation and the Calumet & Arizona Mining Co., for alleged infringement of patent, have been taken in Houghton, Mich. The consolidated case against the two companies has been set for trial by Judge Sawtelle of the Federal District Court for Arizona at Tucson, Ariz., July 5. It is a suit for alleged infringement of the patent of George Campbell Carson, who claims to be the originator of the side-wall feeding furnace used in smelting. His claims for damages have been taken over by the Carson Investment Co. of Nevada. The company won its first case, against the American Smelting & Refining Co., but lost the second case brought against the Anaconda Copper Mining Co.

Depositions of nineteen witnesses, the majority of them former employees of the Dollar Bay, Mich., copper smelter, have been taken in Houghton. Later, the depositions of eighteen will be taken in Detroit and three in Lansing, Mich.

The first case against the American Smelting & Refining Co., which the plaintiff won, now is in the hands of a master appointed by the trial judge, for an accounting. The second case, which was won by Anaconda, was appealed by the plaintiff and will come up for decision in the United States Court of Appeals at San Francisco next fall. The litigation, including that to be started July 5, involves millions of dollars.

Suit also has been instituted by the Carson Investment Co. against several other companies in the West. These cases will be heard later.

Beaver Mine in Ontario to Be Reopened

One of the old-time silver producers in the Thunder Bay district of northern Ontario, the Beaver mine, is to be unwatered at once with a view to reopening it and working it again, it is understood. New York capital has become interested in the prospects for this property, and this action follows the report of S. H. Brockunier, who made an exhaustive study of several of the locations in this section last season. He concluded that the Beaver offered a fair opportunity for capital.

The Beaver mine was closed down in 1891 after producing over half a million dollars. In 1907 a new mill was constructed at the Beaver, the old one having been burned. It was the intention to concentrate low-grade ore from the dumps and new ore from the mine, but with the first run the mill was found to be of faulty construction, and incapable of treating the ore, so the plant was again closed down. It has long been the contention of mining men in northern Ontario that this mine, one of the richest in the district, would furnish an excellent test as to whether properties closed in the "crash" when silver prices suffered a severe fall could be worked profitably under existing conditions.

Temporary Shutdown for Monterey Smelter

THE lead smelter of the Cia. Minera de Peñoles, subsidiary of the American Metal Co., will be shut down for a period of six weeks, according to a report originating in Mexico, and confirmed at the New York office of the metal company. The primary purpose is to permit the installation of new fume-saving equipment and the making of minor changes in the plant. However, a temporary decline in Mexico's extremely high current rate of lead production also will result. A beneficial effect on the lead market is seen by producers in the United States.

Operations in the Pioche District Expand

Production continues steadily from the Combined Metals mine at Pioche, Nev., daily tonnage from the main bedded areas now approximating 105 tons. Recent development work done by churn drilling has largely increased the ore-bearing territory of the company and insured a continuation of the present tonnage for some years. It is reliably reported that tests recently completed have demonstrated that the milling-ore beds proven in the work done four years ago can be made commercially profitable. Work is still being done to determine whether the manganese content of these beds can also be made economically profitable.

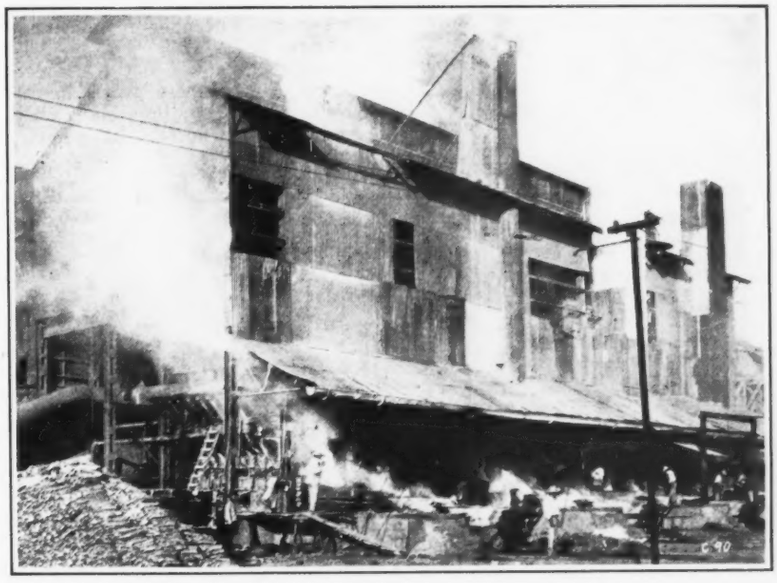
The Pan American Mining Co., of Los Angeles, is planning to develop extensively the Lyndon and Stella properties, in the Comet district. The company is also considering the construction of a milling plant to take care of the large tonnage of low-grade ores now indicated on the property. Lyndon and Stella have been steady shippers of high-grade silver-lead-zinc ores during the past twenty years. George E. Coxe is in charge of the operations.

Long Life Predicted for Miami Copper Co.

At a recent meeting of the Globe luncheon club, F. W. Maclennan, general manager of the Miami Copper Co., made some optimistic predictions regarding the life of the company. In closing his address, Mr. Macleannan stated that if anyone now in the district were there to celebrate the centennial of the mining camp—approximately 1978—that fortunate individual would find the company still in operation, most probably extracting copper from its own great tailing pile.

Mr. Maclennan mentioned the large acreage of tailing and its great value should a process be discovered to extract the copper therein, and said that the tailing of fifteen years ago may become the ore of today. In this connection he stated that the value of copper ore in the tailing in the early days of the plant was greater than that in the ore being mined today. The tailing of fourteen years ago contained about 15 lb. of copper per ton, whereas the ore now being treated contains only 14 lb. The 29,000,000 tons of tailing produced by the Miami Copper Co. in the last fifteen years contains about $34,000,000 worth of copper at a market price of 14c. per lb. Mr. Maclennan also stated that the earnings of the company since its organization in 1906 amounted to $131,000,000, of which $100,000,000 had been paid out for operating expenses and to the state government. There are 9,500 stockholders, and a regular quarterly dividend has been paid by the company from the date of the start of operations.

The mining camp was originally a silver property; this was in 1875. In 1878 copper was hauled to Wheatfields to Mexican adobe furnaces. The first copper was shipped from the Black Warrior claims in 1895. The company attained its highest annual production in 1923 and its lowest in 1926. Present output is about 12,000 tons daily. There were 1,588 employees in 1923 and 907 in 1926.



The tapping floor at the Monterey smelter of the Cia. Minera de Peñoles, S. A., Monterey, N. L., Mexico

Mining Activity in Joplin-Miami District at Low Ebb

Low Price of Zinc Ore Forces More Than Seventy Mines in the Field to Suspend Operations

Because of the low price of zinc ore, mining activity in the Joplin-Miami zinc and lead field is at a lower ebb than for several years. More than seventy mines have been closed because of the impossibility of making profits at present prices, and hundreds of miners, thrown out of work, have temporarily left the field to find work in other sections. It is believed that full production could not be resumed before next fall, even if prices should take a sharp turn upward.

Lee Fillius, manager of the Anna Beaver Mining Co., has resigned; he expects to leave soon for a visit to California, but will return and continue to engage in mining in this field. It is locally reported that his resignation came about through the refusal of Harry Payne Whitney, principal owner of the Anna Beaver, to consent to curtailment of production at the mine. It has been operating double shift regularly, and the fact has brought considerable criticism upon Mr. Fileius.

Plans for the formation of an alumni association of the Rolla School of Mines, at Rolla, Mo., were discussed at a get-together meeting held during the last week at the Connor Hotel in Joplin. M. H. Thornberry, president of the Missouri School of Mines, was the principal speaker.

Cost of production figures for the month of April recently published by the Tri-State Zinc and Lead Ore Producers' Association follow:

Operating Expenses	Cost per Ton of Rock Hoisted	Cost per Ton of Concentrates
Labor	0.9334	14.6921
Supplies and repairs	0.3343	5.2614
Liability insurance	0.0595	0.9359
Explosives	0.1708	2.6889
Exploration and development	0.1317	2.0723
Power, all classes	0.1886	2.9682
Fire and tornado insurance	0.0274	0.4320
Management and office salaries and expenses	0.0891	1.4016
Taxes (excluding federal income tax)	0.0180	0.2837
Miscellaneous	0.0636	1.0018
Total operating expenses	2.0614	31.7379
Amortization of capital cost of		
(a) Depletion	.....	4.0984
(b) Depreciation	.....	2.9054
Royalty	.....	6.1433
Total cost of production	.....	44.8850

Production of Two Zinc Smelters Curtailed

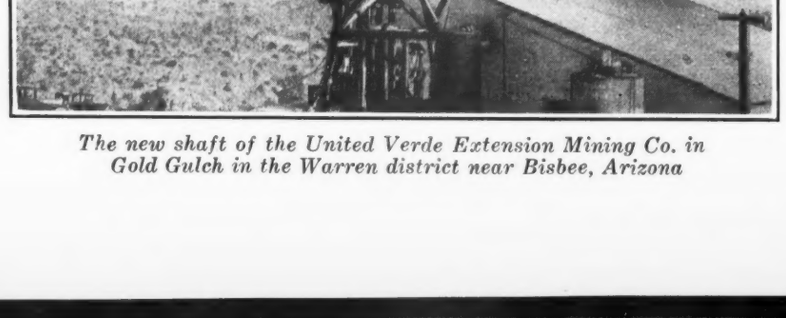
SEVERE WIND STORMS recently occurring in the Mid-West damaged the Falcon Zinc Co.'s smelter at Van Buren, Ark., and that of the Quinton Spelter Co., at Quinton, Okla. The smokestack at the Falcon property collapsed, and it is probable now that the plant, which has been down for about ten days, will remain idle for another thirty days. At the Quinton plant half of the smelter is down for repairs and will probably be out of commission for sixty days.

United Verde Extension Sinks Shaft in Gold Gulch

Until recently the impression prevailed that there was not any ore in the Bisbee camp outside of the known orebodies adjacent to Sacramento Hill. This comprised the regular and well-known orebodies of the Copper Queen, and the ore in the Briggs and Junction mines of the Calumet & Arizona Mining Co. Some pioneer work was done by the last-named company through its Cole shaft, which proved the location of ore on the side lines of the Tuscarora claim, on the west slope of the Mule Mountains, near the small town of Don Louis, and several miles from the original ore finds at Sacramento Hill. Leasers, working through the Boras and Nighthawk shafts, still further developed this ore, and at the present time the Copper Queen has gone about half a mile further west, beyond the Wolverine holdings, and is putting down a series of diamond-drill holes to find out if any orebodies exist still further to the west.

Prospecting being carried on by the United Verde Extension in Gold Gulch is about three-quarters of a mile east of the Ivanhoe and two miles from the Campbell shaft. The direct reason for sinking the shaft, which is shown in the accompanying photograph, is to prospect beneath a number of siliceous outcroppings.

In many instances in the Bisbee district, where prospect work has been carried on under similar outcrops, good bodies of high-grade ore have been discovered.



The new shaft of the United Verde Extension Mining Co. in Gold Gulch in the Warren district near Bisbee, Arizona

Weepah Now a Normal Prospect Camp

Growing Slowly, With a Population of 600—Wooden Buildings Replace Tents

Weepah has settled down to the normal conditions of a prospect camp. The district is growing slowly with an estimated population of 600 at present. Carpenters are erecting wooden buildings to replace the tents; and about seventy men are working on the prospects. The present workings appear to have indications that justify further prospecting, but at present development has been too limited to make possible any trustworthy appraisement of the properties.

Frank Horton, manager of the Electric Gold Mining Co., is proceeding with shaft sinking, crosscutting, and drifting, besides doing some trenching in the vicinity of the original surface discovery. A number of leases have been granted for surface work on the Electric property. The lessees are closely following the methods of the early prospectors in Tonopah and Goldfield, and some of them are already producing small quantities of commercial ore. The Seymour lease recently shipped several tons of sacked surface ore worth about $1,300 a ton. A small hoist and a compressor have been installed at the Electric property; in all the other operations in the district windlasses and hand tools are used. Several other properties have small gasoline hoists on the ground, but as yet these are not in operation.

Promoters have criticized Mr. Horton for refusing to join in their plans to capitalize the publicity given the district. His attitude appears to be one of conservative development for the district, whereby he will not be responsible for financial losses to investors in quickly formed promotions.

Rush in Kamiskotia Area

As the result of discoveries just made on the Chevier-Mulligan properties, the Kamiskotia area of northern Ontario is the scene of a new rush, with a large number of prospectors now staking claims and more making preparations to go in. In this section some good showings, very much mineralized, have been revealed. Test pits are to be sunk and a government assay is to be made of the showings. One deal involving $500,000 for a group of fifty-two claims is reported, and staking now being done is tying on to the Chevier-Mulligan claims in McArthur Township.

It is stated that the Kamiskotia copper field is blanketed by pulp-wood rights. No one can do any mining work without getting special permission. With prospectors eager to get on the ground, and with the first of the assessment work coming due July 15, there is naturally some concern among prospectors as to whether work is going to be held up. Because of desire to protect pulp-wood and timber rights, and at the same time provide adequate measures to meet within reason the requirements of mining men, the departments of Mines, and Lands and Forests are giving the matter careful consideration.

Famous Old Mowry Mine Sold to National Lead Co.

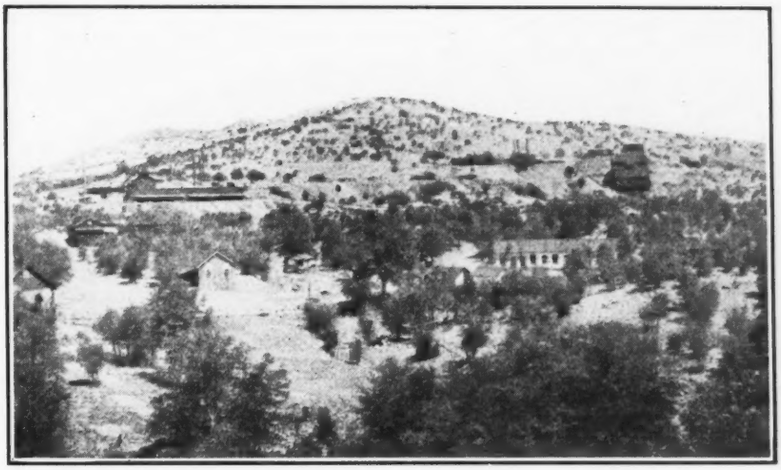
Jesuit Fathers Said to Have Known of Property—Sold to U. S. Army Officer in 1859

The old Mowry mine, about nine miles from Patagonia, in Santa Cruz County, Ariz., is reported to have been sold to the National Lead Co. by A. J. Hazeltine, of Warren, Pa., the former owner. The mine was located about the middle of the last century and worked by Mexicans, but is said to have been known to the Jesuit Fathers long before. After the Gadsden Purchase, it was relocated, and in 1859 was sold to Lieutenant Sylvester Mowry, of the United States Army, who was then stationed at Fort Crittenden and who is said to have spent about $200,000 in purchasing and equipping the mine. He operated the mine successfully for about four years, employing about 120 men, and is said to have shipped $1,500,000 worth of ore. Most of the shipments were made to San Francisco, and to London via Guaymas, Mexico. Much of the ore was smelted and some bullion was refined in crude adobe smelters on the ground. Transportation was by means of wagons to Guaymas, a distance of approximately 300 miles.

Constant raids of the Apache Indians, and the breaking out of the Civil War, with the attendant withdrawal of army garrisons, greatly retarded the development of the Patagonia country. In 1862 the mine was seized by the United States Government, on a charge that it was furnishing lead to the Confederate Army for ammunition. Lieutenant Mowry was taken to Yuma for trial, and though the charges were never proved, the long delays, and bad management of the mine during his absence, prevented its being rehabilitated during his lifetime. After his death it passed out of the hands of his heirs. In the early seventies the mine is reported to have been worked by jumpers, but was practically abandoned after gophering and subsequent caving had ruined the workings.

The mine was later acquired by relocation by Tucson people who are said to have taken out ore valued at about $75,000. They sold the property during the eighties to a group of Tucson merchants, who spent considerable money in reopening the workings, and, after reimbursing themselves for their expenditures, sold the property at a profit. In 1904 the Mowry Mines Co. purchased the property and equipped it with a concentrator and 100-ton smelter. In 1907 about 200 men were employed at the mines, and considerable concentrates and crude ore were shipped. During recent years the mine has been worked under bond and lease.

The ore is mainly argentiferous, the minerals, cerussite, coarse galena, and anglesite, all contained in a manganiferous and ferruginous gangue. There is little quartz and no zinc. The ore is oxidized down to about the 300 ft. level. Copper and iron sulphides make their appearance at about 400 ft. The ore is said to have averaged about $40 per ton; past production is valued at about $2,000,000.



The Mowry mine, near Patagonia, in Santa Cruz County, Ariz.

Callahan and Dickens Push Development Work

The annual meeting of directors of the Callahan Zinc-Lead Co. was held in Wallace, Idaho, May 24. Directors from a distance attending were M. G. Rodearmel, vice-president, and Dr. J. S. Macnie, of Minneapolis; Gust Carlson, of Duluth, and John Borg, of Hackensack N. J. All officers were re-elected —namely, D. A. Callahan, president; M. G. Rodearmel, vice-president, and C. W. Newton, secretary-treasurer and general manager. Production of the Callahan company is now limited to the Galena mine, two miles west of Wallace, where a mill of 150 tons' capacity is in operation. At the meeting of the directors approval was given to extend the shaft 600 ft. deeper, which will make it 2,000 ft. deep. It was also decided to continue drifting east on the 600 level where the outlook is favorable for the development of a new orebody. Successful development of the Galena by the Callahan company has attracted unusual interest, as it is situated in a section of the Coeur d'Alene district that has long been viewed unfavorably by generally accepted geological opinion.

The Dickens Consolidated Mining Co., of Wallace, is also apparently in line to upset another long standing theory regarding ore deposition in the Coeur d'Alenes. The Dickens mine is situated on Moon Creek, in a section that had been mapped as Prichard slate, and which therefore was shunned by capital seeking lead-silver mines. Nevertheless, spasmodic development covering a long period of years disclosed lead-silver and zinc ore down to a depth of 200 ft. Recently the Dickens company sank the shaft another 100 ft., entered the Revett quartzite formation, crosscut to the vein, and exposed seven feet of lead-silver ore of good grade and containing very little zinc.

Harriman Mine Makes Test Run

The Harriman mine, near Chinese Camp, Calif., has completed a test run in a ten-stamp Straub mill. The ore, assaying about $12 per ton, was stoped from a 4-ft. vein on the 200 level. An additional ten-stamp mill has been ordered as well as air drills and pumps.

Cape Breton Mining District Attracts Attention

There are many signs of growing activity in the mineral area of Cape Breton, Nova Scotia. One of the most important of recent announcements is that the American Cyanamid Co., of New York, which has been doing development work at the Stirling zinc mines in Richmond County, about 45 miles from Sydney, has sold its interests to the British Metal Co., of London, England. The mine, which is 400 ft. deep and has underground workings a quarter of a mile in extent, is now being dewatered. Government reports state the orebody at the Stirling mines is 90 ft. wide and shows zinc values from 10 per cent up to 30 per cent, with additional values in copper, gold, and silver. The British Metal Corp. is operating the Smithfield silver and lead mine, located 20 miles from Truro. It is also interested in other areas in northern Ontario and Quebec.

The Consolidated Mining & Smelting Co. has an engineer in Cape Breton looking over the different properties the company has secured from the Nova Scotia Government, and has staked out about fifteen square miles of promising area. Mond Nickel Co., of Coniston, Ontario, has had an engineer in the district investigating a silver-lead prospect within easy reach of Sydney. Iona Gypsum Co., Ltd., is about to spend a quarter of a million dollars extending its plant and piers to handle gypsum for export.

This summer a number of big companies will send field engineers into the district to study different properties that have been held by speculators for the last thirty years. Under the new mining law, recently adopted by the Nova Scotia Government, lessees holding areas may be deprived of them if, after six months' notice, they fail to operate.

Galena Discovery in Ontario

What is believed by the owners to be one of the richest finds of galena in the northwestern Ontario districts has been uncovered at Silver Lake, two miles south of Loon, by a party of Port Arthur prospectors headed by William Longworth.

Toronto Letter

By Our Special Correspondent for Northern Ontario

New Sylvanite Mill in Operation —Activity in Eastern Part of Kirkland Camp

Toronto, June 4—The new mill of the Sylvanite mine, of Kirkland, has started operations and at the present time is treating about 100 tons of $6 ore a day. This grade will be maintained until the mill is further improved; it is expected that about the first of next month the tonnage and grade will be substantially increased. At present a considerable part of the mill feed is being obtained from surface dumps. Underground developments continue satisfactory, and new ore of good grade has recently been found on the 1,500 ft. level.

On the Kirkland Lake Gold property the oreshoot on the 2,475 ft. level has been drifted on for a length of over 150 ft., the last few rounds having an average of approximately $50 to the ton. In this same drift what appears to be the apex of another orebody has been encountered and preparations are being made to again sink the main shaft.

The Macassa property, adjoining the Kirkland Lake Gold, has been closed pending further financing. Since the new company took over the Macassa, $165,000 has been spent on diamond drilling and underground work, but it is believed that deeper exploration than the present 500 ft. level is necessary.

In the eastern section of the Kirkland camp there is a good deal of activity. Operations are being continued on the Conroyal, and the Pawnee property adjoining is being reopened. The Gull-Kirkland is to be diamond drilled, and the Bidgood and Wood-Kirkland will also be reopened. Arrangements are being made to raise enough money to continue the Queen-Lebel shaft to 1,000 ft.

The new company which is taking over the Crown Reserve property, in Larder Lake, will soon start diamond drilling, and if this succeeds in indicating more ore, underground operations will be resumed. The property has a substantial tonnage of $6 to $7 ore, and, with the Kirkland branch being extended into Rouyn, it should be possible to treat this ore at a profit by shipping the concentrates to the Noranda smelter. A fund of $50,000 has been raised to carry on the preliminary work, and, if this is satisfactory, no trouble should be experienced in raising more money. The chairman of the Temiskaming and Northern Ontario Railway states that trains will be running into Rouyn over the new branch by next Christmas. Good progress is being made with construction, and the work is ahead of schedule.

At the Barry-Hollinger property good discoveries are reported on the 800 and 1,000 levels. The main vein on the 1,000 level was drifted on for about 60 ft. from the crosscut before commercial ore was encountered, but the last few rounds have shown considerable free gold.

Several Properties Transferred at Alaskan Camps

Riverside Mine Ships Concentrates to Selby Smelter—Placer Gold Strike on Nome River

Development has been resumed on the Gold Cliff, Premier, and Stoner mining properties, immediately southwest of the International Boundary, in the Portland Canal district of British Columbia. The Riverside mine, 7 miles north of Hyder, is now in steady operation, with the mill running full time. The first shipment of concentrates for the season amounted to 45 tons, when shipping had to be suspended owing to the bad condition of the road to Hyder. Concentrates are now being shipped to Selby smelter. The American Mining & Milling Co. plans resumption of development on its Fish Creek properties, east of the Riverside. Two new mining companies have been incorporated at Ketchikan: The Thorne Arm Mining Co. registered with a capital of $300,000 to develop the gold mine at Thorne Arm, Revillaggido Island, and the Dolomi Co., incorporated with a capital of $50,000, to work the Dolomi mine.

The liquidators of the Alaska-Gastineau Mining Co. have sold the Thane townsite at Juneau, together with the warehouses and docks, to promoters of a large pulp company being organized in California and Oregon. The Hirst-Chichagoff Mining Co., of Seattle, has completed the purchase from B. Hirst and associates of the mine at Hirst Cove, on Chichagoff Island. This mine is equipped with a ten-stamp mill, and is developed by three levels, the lowest of which connects with the mill and is 1,800 ft. in length. At this property oreshoots are from 75 to 200 ft. in length and carry gold values in veins 2 ft. to 3 ft. wide.

J. J. Godfrey, of New York, and C. F. Whitham are developing a new lead camp on the north side of Mount Wrangell, at the headwaters of the Tanana and Copper rivers. The Granby Consolidated Mining, Smelting & Power Co. has had a crew at work dismantling and removing the machinery and tramway at the Midas copper mine, in Solomon Basin, on the south side of Valdez harbor.

A strike of gold on the former military reservation on Nome River at Nome has aroused much interest among placer men. Three test shafts were sunk and all showed placer gold. There is a difference of opinion as to whether the strike is on a continuation of the second bench paystreak, or in an old channel of Nome River.

Clay Reduction Co. Acquires Aluminum Process

The Clay Reduction Co., of Chicago, Louis Birkenstein, president, has acquired of Segland Svendsen, formerly of Sarpsborg, Norway, his method for the manufacture of alumina. This method, which is particularly adapted for siliceous raw materials, such as common clay and bauxite of a high silica content, is said to produce a greater yield of alumina than methods now in use.

London Letter

By W. A. Doman

Special Correspondent

Consolidation of Tin Interests Reported—Mount Isa Option Again Prominent

London, May 24—Bull traders in tin have not expressed themselves so hopefully during the last week. Whether it is the fact that prices have gone against them, or that trade has not revived as quickly as was expected, is not clear. In any case, speculators are less happy than before. It would almost appear that "shorts" are trying to gain the ascendency, for there is talk of the number of new producers and of attempts to find substitutes for the metal. In due course the new producers should make their influence felt, but there are always ways of regulating output. Various companies are consolidating, but whether this is the beginning of a move toward control in this country cannot yet be determined.

The Kafir market has received a severe blow. Several blocks of the shares that had for some time been pushed up beyond their intrinsic merit —if such an expression may be used— were listed in Berlin, and, owing to the action of Dr. Schacht in forcing the banks to curtail their loans by 25 per cent, are now being resold here through Paris and Brussels.

The old story of friction between the boards of management of the Rhodesia Exploration and the Globe & Phoenix is being revived. The first-named company, it is said, complains that its rights are being violated. Presumably this refers to the "extra-lateral" question. The view expressed is that the matter is certain to become delicate before many months elapse.

The Mount Isa option is again coming into prominence, and much interest centers upon the arrival here of W. H. Corbould, the company's consulting engineer.

Affairs of the Panama Corporation seem to have taken a brighter turn. W. H. Chaplin, an engineer connected with the company, has started for the property, and it is believed that he would not have been sent on the mission unless there were good results to check.

Publication by the Anglo-American Corporation of South Africa of the costs per ounce of gold produced by the mines on the Rand under its control is still being discussed, and attempts are being made in certain quarters to discourage the practice, on the ground that the public would get bewildered and could not make proper comparisons. A reader of *The Financial News* has sent to that journal a critical examination of the first quarterly progress report of the year of some of the Rand mining companies. As he analyses the position, the results are rather startling, for the net return on the current prices of the shares is scarcely more than can be obtained on gilt-edged investments, and nothing is allowed for amortization of capital.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal Platinum Dissolved —Work of Salvaging the "Grosvenor" Proceeds

Johannesburg, May 3 — The return for March, recently issued by the Department of Mines, shows the total value of the Union's mineral output for the month to be £5,263,739. This is an increase of £92,926 over the January figure, which was the previous record. As compared with March, 1926, the value for March, 1927, shows an increase of £509,944. Details of the Union's mineral output for the first quarter of last year and for the same period of this year follow:

	1926	1927
Gold	£10,142,540	£10,544,954
Silver	32,756	29,262
Osmiridium	26,959	16,347
Platinum	.....	64,157
Diamonds	2,203,129	3,439,959
Coal	920,025	893,700
Copper	134,298	150,298
Tin	70,994	98,995
Other minerals	64,784	99,381
Total value	£13,595,485	£15,337,053

An extraordinary meeting of shareholders in Transvaal Platinum, Ltd., was held in Johannesburg on April 29, W. H. A. Lawrence presiding, to pass the necessary winding-up resolutions. The accounts showed a net deficit of £25,528, 16s. 1d. T. C. L. and South African Townships have a first-mortgage bond over all the company's assets. Two shareholders, J. McLaren and R. Paterson, criticized the conduct of affairs, but the motion of the chairman that the company should be wound up was seconded by E. M. Hind and carried with only two dissenting votes.

A strike was declared by underground workers on the City Deep mine, on April 26. The Chamber of Mines regards this as a defiance of the Conciliation Act. Negotiations for a settlement are, however, proceeding.

The British India R.M.S. "Khandalla" sailed from Durban on April 25 carrying £200,000 in gold coin and bullion to Bombay. The steamers "Gujarat" and "Kawachi Maru," which sailed for the East a few days previously, also carried a consignment of gold valued at £67,000.

Northern Platinum Exploration, Ltd.'s, report for the quarter ended March 31 shows a total development of 930 ft., of which 601 ft. were on reef; 540 ft. were sampled and the average assay value was 5.92 dwt. over an average channel width of 27.7 in.

The Grosvenor Bullion Syndicate, Ltd., at Durban, has received an offer on behalf of Theodore Pitcairn, an American, to purchase the whole undertaking of the syndicate. The face value of Pitcairn's holding is £6,521 and he has just put another £500 into the scheme. The "Grosvenor," an East Indiaman, said to have had £1,000,000 on board, was wrecked 25 miles north of St. John's in 1782. The salvage work has already begun under the new management.

Amalgamated Zinc Investigates Paper Manufacturing

At a general meeting of shareholders of Amalgamated Zinc, Ltd., held in March, 1927, the decision was reached to expend a part of the liquid assets of the company, which total £250,792, on investigations of commercial production of paper from eucalyptus in Tasmania. Amalgamated Zinc has for some time flirted with the idea of engaging in the new venture with the objective of continuing its corporate existence and developing a commercial enterprise. Its activities at Broken Hill are now greatly restricted. The company faced the prospect of liquidating or of embarking upon a new enterprise. A majority of the stockholders voted to enter upon the new enterprise. Members of its technical staff had investigated the possibilities of wood-pulp and paper manufacture, and had reached the conclusion that there was promise in this new direction.

Amalgamated Zinc has been generally concerned in metallurgical processes and in participation with other interests was instrumental in initiating processes for the hydrometallurgical treatment of zinc concentrates which were eventually put into practice by the Electrolytic Zinc Co. of Australasia, Ltd.

Increased Appropriations Sought for Bureau of Mines

Senator Oddie, chairman of the Senate Mines and Mining Committee, is leading a campaign for increased appropriations for the Bureau of Mines for the year beginning July 1, 1928. He is being supported by mining men and organizations. Preliminary estimates will be received by the budget bureau July 15 and the final estimates Sept. 15. They will be submitted to Congress at the opening of the regular session in December and be embodied by the House Appropriations Committee in the Department of Commerce appropriation bill.

Mineral Production of British Columbia for 1926

Valuation for the Year $67,188,842— Approximately 10 per Cent Is Distributed in Dividends

The annual report of the minister of mines for British Columbia for 1926 was issued on June 2. It was compiled by John D. Galloway, provincial mineralogist, and in his statistical review of the mining industry during the year he emphasizes the remarkable strides that the industry has made since 1921 —the year of general depression in the metal industry throughout the world. In 1921 the value of the mineral output of the province was $28,066,641, and it has risen by increments of nearly $8,000,000 per year to $67,188,842 in 1926. With the exception of gold and coal, all metals and minerals show increases in output in 1926, compared with the previous year, though, owing to the decrease in metal prices, the value of the lead output is less in 1926 than in 1925, despite the fact that the output is nearly 25,000,000 lb. greater. Approximately 10 per cent of the value of the 1926 production was disbursed in dividends, while the gross profits of operations were about 25 per cent.

Notable increases in the outputs of lead and zinc are due chiefly to expansions at the Consolidated Mining & Smelting Co.'s Sullivan mine.

At the Trail smelter, the lead refinery was increased to a capacity of 400 tons of refined lead, and an entirely new electrolytic zinc plant of 80 tons' capacity was started, which, when completed, will raise the total zinc capacity to 280 tons per day. The custom concentrator at Trail was increased in capacity from 300 to 600 tons per day.

Mr. Galloway's report is well illustrated and contains details of the mines and prospects in the province at which important work was done during the year. The provincial department of mines has six mining engineers in the field collecting report data, which are assembled at the department's offices in the Parliament Buildings, Victoria, B. C., shown below.

Parliament Buildings, Victoria, B. C., Canada

News From Washington

By PAUL WOOTON
Special Correspondent

Work at Experiment Stations of the Bureau of Mines Under New Arrangement

WITH THE TITLE of "Chief Engineer of the Division of Experiment Stations," Arno C. Fieldner, now in charge of the Pittsburgh station, on July 1 will take over the direction of the work at all the experiment stations of the U. S. Bureau of Mines. Under the new arrangement his headquarters will be in Washington. He will succeed Dr. Dorsey A. Lyon, who has asked to be relieved of his duties as Supervisor of Stations and as Chief Metallurgist, that he may concentrate his efforts at the Bureau's Intermountain Station at Salt Lake City, where the Bureau will co-operate with the University of Utah in an amplification of the service now being conducted at that station.

Mr. Fieldner's intimate knowledge of the extensive research activities of the Bureau's largest station will be brought to bear on all the field stations. He has shown his capacity in maintaining a high plane in the research work at Pittsburgh, and also has proved his ability to co-operate successfully with the mining industry. He will make a special study of the work and needs of each station, with the idea of improving the grade of work which is being done at the mining experiment stations.

Mr. Fieldner, who is forty-six years old, graduated from Ohio State University in chemical engineering in 1906. After graduation he was engaged on industrial fuel engineering work with the Denver Gas & Electric Co., Denver, and later as chemist and assayer for the American Zinc & Chemical Co. at the same place. In 1907 he entered the employ of the U. S. Geological Survey as assistant chemist in the technologic branch and was engaged on analysis of coal, coke, petroleum and other fuels, and special research in connection with the utilization of these fuels. In 1910 when the Bureau of Mines was created and took over this work Mr. Fieldner was in charge of the fuels chemical laboratory and subsequently was placed in charge of the gas laboratory also.

At the beginning of the World War Mr. Fieldner turned his attention to gas-mask research, first at Pittsburgh and later at the American University Experiment Station at Washington, D. C. He was later commissioned as a major in the Chemical Warfare Service and placed in charge of the gas-mask research section of the Research Division, Chemical Warfare Service. Mr. Fieldner personally developed the original methods for testing the efficiency of gas masks and absorbents. These methods were generally used throughout the war, and were later adopted by some of the laboratories of the allies.

After the war Mr. Fieldner returned to Pittsburgh as supervising chemist of the Pittsburgh Experiment Station of the Bureau of Mines, and in June, 1921, was made superintendent in charge of the entire station. In 1925 he was appointed chief chemist of the Bureau of Mines with headquarters at Pittsburgh, still retaining charge of the station as superintendent. During this period he organized and directed the classic research work of the Bureau in co-operation with the New York and New

Arno C. Fieldner

Jersey Tunnel Commissions on the composition of automotive exhaust gases and the minimum safe concentration of carbon monoxide in tunnel atmospheres. In a similar manner in co-operation with the chief surgeon of the Bureau, he subsequently organized and directed a co-operative research problem on the effect on health of automotive exhaust gases containing tetraethyl lead, and vapors of gasoline containing the same material. He also directed valuable research work resulting in the application of gas masks to industrial purposes.

In 1924 Mr. Fieldner spent six months in visiting European laboratories and industries, studying especially the carbonization and processing of coal, and safety in mines research. In this connection a special study was made of low temperature carbonization, results of which have been published in a technical paper of the Bureau of Mines and in a number of articles in the technical press. In the metallurgical field he was largely instrumental in the successful launching of the co-operative research program at the Pittsburgh Experiment Station on the study of physical chemistry of steel making,

Mr. Fieldner has contributed a large number of articles to the scientific and technical press and is the author of a long list of bulletins and other publications of the Bureau of Mines. He has been very active in technical and scientific societies and in co-operating with industrial organizations.

University of Utah Approves Research Program

With the increased support given its department of mining and metallurgical research, the University of Utah has approved an ambitious program of investigations. Under the direction of Dr. Lyon it is expected to take up the following flotation problems: Differential lead-zinc separation; flotation fundamentals of the copper sulphides; flotation of copper from converter slag and of cement copper; flotation fundamentals pertaining to the oxidized copper minerals; sulphidizing preceding flotation of oxidized lead and zinc minerals; flotation of pyrite and pyrrhotite from lead-zinc and copper circuits; flotation fundamentals of the rare metal ores; flotation of non-metallic minerals; the effect of clayey matter on the flotation of sulphide minerals.

Metallurgical problems have been outlined as follows: Roasting of zinc ores; roasting of oxidized lead-zinc ores; losses of lead in slag; saving of sulphur in smelter smoke; leaching of lead; direct reduction of sulphide ores by hydrogen. Crushing and sizing investigations to be undertaken follow: Determination of the area developed by crushing and its application to the determination of crushing efficiency; investigation of crushing by heating and quenching; investigation of industrial screening. The chemical problems outlined are: Preparation and testing of new chemical compounds as flotation reagents; determination of the solubility of minerals in water and in the presence of solutions; concentration, extraction, and uses of Utah hydrocarbons.

While the department of mining and metallurgical research of the university and the station of the Bureau of Mines will be entirely separate entities, they will co-operate in the handling of such problems as may be agreed upon. With Dr. Lyon as the executive of each agency there will be absolute assurance against duplication of work and of the complete co-ordination of the co-operative investigations undertaken.

Co-operative arrangements between the Bureau of Mines and state universities date from 1913. They were favored by Dr. Joseph A. Holmes, the first director of the Bureau. The first arrangement was with the University of Utah. The Utah Legislature in 1913 appropriated $7,500 for this co-operative work. Dr. Lyon organized the initial work, and it was conducted for three years under his direction.

In addition to appropriating $45,000 for an addition to the mining building at the university, the last session of the Utah Legislature voted $20,000 for the co-operative work. The mining industry in Utah has been very active in connection with this increased study of mining problems, and an advisory committee is to be set up. J. O. Elton, the general manager of the International Smelting Co., is to be chairman of the committee, which will include Louis S. Cates, vice-president of the Utah Copper Co., and A. G. Mackenzie, secretary of the Utah chapter of the American Mining Congress.

Situation at the Mines

Marked Curtailment in Zinc Production—Slight Additional Reduction in Copper Output—Trend Toward Curtailment Noticeable Among Lead Producers

By H. D. Keiser
Assistant Editor

THE PERSISTENT DECLINE in the non-ferrous metal prices current during the last month has had the effect of reducing production at the mines, especially in the zinc-mining districts. Curtailment in copper production appears to have grown slightly, and there is a noticeable trend toward curtailment among the lead producers. Many districts are continuing with extensive programs of development with the evident intention of retaining employees in the hope that market conditions will soon be more favorable.

Copper

Despite the low price of metal, operations in the Michigan copper district continue active and in many instances increases in production as well as in the extent of development operations are being made. The Mohawk mine is maintaining its high rate of production; Seneca is increasing its tonnage; and Quincy, Mayflower-Old Colony and the Calumet & Hecla development operations are continuing to encounter considerable commercial ore.

A slight additional curtailment of production is evident on the part of Arizona producers. Another company to join the ranks is the New Cornelia, which is now operating about 12 per cent under normal. The parent company, Calumet & Arizona, is also beginning to curtail. Undoubtedly if the recent drop in the price of copper continues for any length of time, further curtailments will soon be evident. It is believed that the recent action of the Inspiration directors in passing the dividend on top of a curtailed program is indicative of the steps taken toward retrenchment. During May, the new concentrator of the United Verde Copper Co. was put in operation. This plant has a total capacity of 1,200 tons daily, and though not increasing the daily production, will treat the lower-grade siliceous ores, which cannot be smelted direct. Recent underground exploration at Cananea, in one of the raises which checked a diamond drill hole, has proved the existence of the same high-grade ore as that obtained in drilling. In the new bonanza orebody of the Calumet & Arizona Mining Co. at Bisbee a new drift is being driven on the 2,000 level to prove up the existence of the orebody at that depth. This lower drift will be extremely significant because the new orebody, which has been blocked out on the 1,500, 1,600, 1,700 and 1,800 levels, has increased in area with depth. Sinking is still in progress at the United Verde Extension shaft in Gold Gulch, southeast of Warren, and also at the Dowell shaft of the Copper Queen, north of Warren. The Moctezuma Copper Co. was temporarily hampered by a timber fire on one of the haulage levels, but this has now been bulkheaded off and is under control. Operations in the Butte district continue active, with considerable development work in progress.

Lead and Zinc

In the Joplin-Miami district the entire month of May seems to have been given over to the effort on the part of the operators to effect drastic curtailment to prevent prices for zinc concentrates from going lower. At the beginning of the month a total of 135 mills was reported in operation, and at the end of the month the number had decreased to 109. Twenty-five of these mills, however, were re-treating tailings. The weekly production of concentrates decreased from 14,918 to 12,899 tons. The latter tonnage represents a curtailment of approximately 25 per cent for the district.

The persistent decline in the price of lead is having a noticeable effect in the Coeur d'Alene district, Idaho, although no public announcement of curtailment has been made by the chief operators. No employees are being laid off, but when a man quits the vacancy is not filled. More attention is being given to development, the policy of the companies being to provide employment for their men, evidently believing that by midsummer there will be an upward movement in the price of lead which will permit return to maximum production. Production in May, however, was little if any below normal.

Lead-Silver

As far as Arizona operations are concerned, the large lead operators are apparently optimistic over the future of the silver market, in spite of the recent drop in price. Not only is the Phelps Dodge Corporation adding a lead unit to the smelter in Douglas, but it has leased the mill at Humboldt and is equipping it to handle silver-lead ores from the northern part of the state. The Calumet & Arizona company has taken over the claims of the Hiltano Development Co., about 30 miles east of Tucson, which are said to have produced over $100,000 worth of lead last year. National Lead is reported to have purchased the old Mowry mine, near Patagonia, which was a famous silver-lead producer during the Civil War period, and it is reported that the Eagle-Picher Lead Co. also has acquired property in the same district.

Conditions at the Utah mines continue about the same as at the end of the previous month. Shipments show but little reduction during the month of May as compared with April. Curtailment, if it is contemplated, has not yet shown an appreciable effect, at least with regard to shipments. Lead output is probably being reduced automatically by constantly receding prices, particularly in the case of small mines. Some mines are shipping as little lead as possible and confining their attention to gold and silver ores. Few mines, however, are able to discriminate, so the effect of this policy would be small. Actual curtailment, so far, has been very small or nil.

Gold and Silver

In Yuma County, Ariz., activity is centering around Kofa, where it is reported a townsite has been staked out and a company formed to develop the district. The old Vulture mine, a famous gold producer of the past, was recently sold to Waterbury, Conn., capitalists. A new body of ore was reported as the result of examination work in the upper levels of the old Congress mine, a former Frank Murphy holding. Weepah, Nev., has settled down to a conservative development. Approximately seventy men are employed in the field; the population is growing slowly and the town is acquiring the appearance of a normal prospect camp.

Conditions in the Tonopah district remain unchanged. The estimated bullion production of the district for May is placed at $140,000. The Tonopah Divide company recently discontinued operations in the Midway mine, one of the oldest active properties in the district. There has not been any change in the Yukon-Treadwell operations at Tybo, but at Keystone the company has encountered 6 ft. of mill ore and 20 ft. of low-grade ore on the 160 level of the prospect shaft. The White Caps property has temporarily discontinued shipments to the Mason Valley smelter, owing to an increase of water in the mine and the caving of a stope. Operations in the Goldfield Deep mines have been retarded by flooding.

Iron

Iron ore is not moving from the mines to the docks at a very rapid rate on the Michigan ranges, although the movement during May was about 1,000,000 tons in excess of the 1926 figures for that month. Shipments totaled 7,350,000 tons from the entire Lake Superior district. The Carpenter mine of the M. A. Hanna Co., at Crystal Falls, has been closed, it is said, because of lack of ore sales. The Plymouth mine of Pickands, Mather & Co., at Wakefield, has cut its working force about in half. Clement K. Quinn Co. have taken over the lease of the Gwinn mine, at Gwinn, and started mining operations there. The property was worked for several years by the Cleveland-Cliffs Iron Co., which surrendered the lease in March. Labor is plentiful on all of the ranges, in spite of the fact that more men are given employment during the summer than in the winter months. All of the open-pit mines are now in operation.

Societies, Addresses, and Reports

International Economic Conference Closes

Recommendations Adopted at Final Session—Results Furnish Basis for Further Economic Co-operation Among Nations

By Edward J. Mehren
Vice-President, McGraw-Hill Publishing Company, Inc.

CLOSING ITS SESSION on May 23 after three weeks of continuous work, the International Economic Conference meeting at Geneva adopted a long series of recommendations on commercial and agricultural topics and three on industrial subjects.

On the whole, the conferees were quite well pleased with the results. The task was a large one, the problems were complicated, and the views quite divergent on many points. A goodly degree of accord has been reached. Compromise has been necessary on many items, but the result, on the whole, furnishes a good basis for further international economic co-operation.

How speedily the recommendations can be translated into action, where definite action is proposed, cannot be foretold. Immediate results must not be expected. The issues would require much time even if only national action were required, but there are various agencies for forwarding the work, such as the economic section of the League of Nations, the International Chamber of Commerce, the International Institute of Agriculture, the International Management Institute, etc. Further, meetings of responsible ministers of the various countries will certainly be convened to consider agreements on various points covered in the recommendations.

Aside from any definite early action there are certain general advantages that should not be discounted. There is now a clear view of the economic ills of the world, and agreement upon remedies, so far as variant national interests would permit. Then there is this great advantage, that ministries can quote the Geneva conclusions in support of sound economic policy and legislation and in opposition to the unsound.

Not all of the economic ills of the world were surveyed at Geneva. The pressing question of the disposal of surplus populations was not touched, due to the fact that it is too political. No attention was paid—or practically none—to the economics of distribution, to the problem of decreasing the spread between manufacturing cost and ultimate selling price. To this problem we are devoting much time in the United States. But, as it was, the agenda was crowded and many topics set down received no attention.

In cable messages and previous articles summaries have been given of the economic situation as presented to the conference and of the resolutions which have been adopted. There remains here chiefly to give more completely the resolutions on industrial pools and rationalization.

Pools or Cartels

Pools or cartels, as already indicated in cables and articles, formed one of the dominant subjects of the conference and resulted in quite a divergence of views. The conclusion was that they must be considered as good or bad according to the spirit of their constitution and operation and the attitude of their managers toward the general interest. The field for such agreements, both national and international, is usually limited, so the conference declared, to branches of production already centralized and to products supplied in bulk or recognized grades. Where applicable they can secure a more methodical organization of production, a reduction in cost by better utilization of equipment, the development on more suitable lines of new plant, a more rational grouping of undertakings, can check economic competition, and reduce the evils resulting from fluctuations in industrial activity. By this means they may assure to the workers greater stability of employment, and at the same time by the reduction of costs and selling prices bring advantages to the consumer.

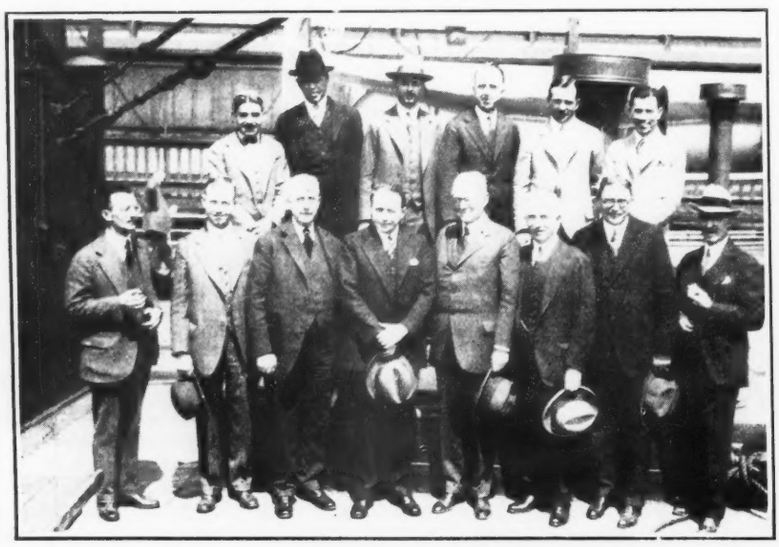
Nevertheless, the resolutions declared, if such agreements encourage monopoly and the use of unsound business methods, they may check technical progress and endanger the legitimate interests of sections of society and particular countries. Consequently such combinations should not lead to artificial rise in prices, which would injure consumers, and should give due consideration to the interests of the workers. They should not restrict the supply of raw materials or basic products to any particular country nor create unequal conditions between the finishing industries of the consuming and producing countries. Nor must they prevent the development in any country of industries which that nation considers indispensable.

On the question of control of pools the conference believed that international control of international pools cannot be set up. It recommends, however, that the League of Nations study these international pools, their effects on technical progress, on production, conditions of labor, supply, and prices.

American Delegates and Advisers at Geneva Conference

The American delegates to the World Economic Conference at Geneva and the expert advisers who accompanied them are shown in the photograph below. In the bottom row, reader's left to right, are: Henry Chalmers, chief of the foreign tariffs division of the Bureal of Foreign and Domestic Commerce; Dr. Arthur N. Young, economic adviser, Department of State; Roland W. Boyden, of Boston, representing the International Chamber of Commerce; Dr. Julius Klein (delegate), director, Bureau of Foreign and Domestic Commerce, Department of Commerce; Henry M. Robinson (chairman of the delegation), president, First National Bank, Los Angeles; Norman H. Davis (delegate), formerly Assistant Secretary of the Treasury and Assistant Secretary of State; Alonzo E. Taylor, (delegate), director, food research, Stanford University; Dana Durand, chief of the research division, Bureau of Foreign and Domestic Commerce.

In the top row are: Dr. Louis Domeratzky, chief of the regional division of the Bureau of Foreign and Domestic Commerce; John P. Frey, editor, *Moulders' Journal*, adviser on labor questions; Edward Eyre Hunt, of Washington, D. C., Department of Commerce; Grosvenor Jones, chief of the finance division, Bureau of Foreign and Domestic Commerce; E. W. Camp, commissioner of customs, Treasury Department, and W. L. Finger, Secretary to Dr. Julius Klein, serving as administrative aide. John W. O'Leary, the fifth delegate, is not shown in the picture.



This information, collected with the aid of the various governments, should be published. Such publicity is an effective means, on the one hand, of securing the support of public opinion for agreements which conduce to the general interest, and, on the other hand, of preventing the growth of abuses.

In this series of articles the term rationalization has been taken to mean all mechanisms for reducing cost of production and, therefore, the consolidation of industries has been included; this broad definition is in accordance with the German acceptance of the term. However, the conference limited it to scientific organization of labor, standardization both of material and of products, simplification of processes, and improvements in the system of transport and marketing.

While obvious to us in America, the conclusions are so important for Europe that they are given here in part:

"The conference considers that one of the principal means of increasing output, improving conditions of labor, and reducing costs of production is to be found in the rational organization of production and distribution.

"The conference considers that such rationalization aims simultaneously:

"1. At securing the maximum efficiency of labor with the minimum of effort;

"2. At facilitating, by a reduction in variety of patterns (where such variety offers no obvious advantage), the design, manufacture, use, and replacement of standardized parts;

"3. At avoiding waste of raw materials and power;

"4. At simplifying the distribution of goods;

"5. At avoiding in distribution unnecessary transport, burdensome financial charges and the useless interposition of middlemen.

"Its judicious and constant application is calculated to secure:

"1. To the community greater stability and a higher standard in the conditions of life;

"2. To the consumer lower prices and goods more carefully adapted to general requirements;

"3. To the various classes of producers higher and steadier remuneration equitably distributed among them.

"It must be applied with the care which is necessary in order, while at the same time continuing the process of rationalization, not to injure the legitimate interests of the workers; and suitable measures should be provided for cases where during the first stage of its realization it may result in loss of employment or more arduous work. It requires, further, so far as regards the organization of labor in the strict sense of the term, the co-operation of employees and the assistance of trade and industrial organizations and of scientific and technical experts."

All of the recommendations covered in the committee reports and resolutions were referred at the closing session to the League of Nations for such action as the various items required At the same time the various international organizations previously referred to will take these matters in hand and cooperate with the various League agencies to secure results.

The Graduate Course in Administration of Mineral Industries

By G. M. Butler
Dean, College of Mines and Engineering,
University of Arizona

THE FIRST YEAR of the course in the administration of mineral industries at the University of Arizona is now drawing to its close, and it is possible to judge of its success and to make some estimate of the value of the training given. The course was not undertaken without a great deal of preliminary thought and study; and, because it involves several unique features, much interest in it has been manifested by mining men and educators.

It was thought unwise to encourage all mining graduates to believe that any course of study would fit them soon to occupy executive positions, for it was recognized that technical and administrative ability are rarely combined in one man, since the successful technician must be mainly interested in things, while the executive deals principally in men. To permit any mining graduate to study an additional year with the expectation that he would thereby be prepared to occupy an administrative position and earn the relatively high salary paid for such work was considered unwise and unjust, since experience has shown that graduates of "administrative engineering" courses are very rarely willing to accept such engineering jobs as are open to recent graduates, and they are almost never able soon to obtain administrative positions. As a matter of fact, it is generally recognized that a man may be an exceptionally capable engineer yet utterly lack the personality and other qualities essential for success in administration.

Reasoning from these premises, it was decided that it would be improper to admit students to the course until they had gained several years of practical experience subsequent to graduation from a good mining college. Of the five men who will complete the course this year one has had twenty-eight years of experience and possesses a master's degree, two have had over fifteen years of experience, one has had about eight years, and the other three years. Three of the five have specialized in mining, and two in metallurgy.

Believing, however, that something else besides experience was required before a man should be allowed formally to prepare himself for administrative work, it was decided that no one should take the course unless specially selected or very highly endorsed by his employers. In writing to the references given by applicants, the employers were fully acquainted with the nature and purpose of the course, and were cautioned to recommend no one unless he had demonstrated the possession of such qualities as successful administrators must possess. It was recognized that such men would probably eventually work their way into executive positions without formal training; and all that the university hoped to do was to shorten and make easier this period of advancement, and to give the students a rather unusual opportunity to prepare themselves to administer large enterprises.

The work on the campus included courses in public speaking, business and mining law, economics (including advanced accounting), money and banking, a daily seminar in administration, and related subjects. This campus work alternated with extensive field trips during which the operation of the largest mining and smelting plants in the state was observed and studied intensively. The companies whose properties were visited co-operated with the university by allowing their plants to be used as laboratories in which the application of the theoretical principles taught on the campus was demonstrated. Many different mining methods and the latest practice in smelting, concentrating, and leaching of copper ores have been observed. Of more importance is the fact that the companies have freely given to the students every opportunity to see original records and methods.

Perhaps the most difficult problem connected with the course was to select and obtain a man in every way qualified to direct the work. The appointment of Dr. E. P. Mathewson, formerly president of the American Institute of Mining and Metallurgical Engineers, has proven to be a singularly happy solution of this problem, since Dr. Mathewson is not only internationally recognized as an authority in the field of metallurgy, but he has filled many and varied executive positions of great responsibility, and, best of all, he seems to possess to an unusual degree the ability to select and train executives.

So carefully was the work planned before it was offered that only one major change is to be made next year. Instead of alternating the campus and field activities throughout the academic year, the entire first semester will be spent on the campus. In the second semester, two-week periods of campus and field study will alternate.

Although the value of the course cannot be demonstrated conclusively until after it has been given many years and the men who hold the degree of administrative engineer of mines have had an opportunity to demonstrate the practicability of the training received, the co-operating officials are generally enthusiastic about the manner in which the work was conducted and the personnel of the class.

Geological Congress Meets in South Africa in 1929

At a special general meeting of the Geological Society of South Africa, held in Johannesburg on April 27, the Prime Minister announced that an invitation to the Fifteenth International Geological Congress to meet in South Africa in 1929 had been extended and that the invitation was accepted. An organizing committee to deal with the matter was appointed at the meeting.

Recent Technical Publications

Reviews, Abstracts, and References

Business Without a Buyer. By William Trufant Foster and Waddil Catchings, Pollak Foundation for Economic Research. Houghton Mifflin Co., Boston. Pp. 205. Price, $2.

Once in a great while the experts and students of the nation's technical, economic, and social thought condescend to take the layman into their confidence, and to explain to him in his own language those theories and problems upon which these experts and students feed. He is conducted to a high hill, and allowed to view the great economic valley below through the glasses of non-technicalities. Such a pleasant and profitable evening is offered the American business and industrial man, and the student of industrial relationships, through "Business Without a Buyer," the work of W. T. Foster and Waddill Catchings, the authors of the much-discussed "Money" and "Profits."

In spite of all our progress—of increased wages, lower cost of production, high technical attainments, our Federal Reserve System, better living and operating conditions, more conveniences, and a higher degree of general intelligence—our business men still live in perpetual fear of a "business depression." Why, with all this progress has this "cycle of business" not been smoothed out, and "depression" and "prosperity" softened into "good times" and "better times"? The authors answer this question by stating a theory based upon five facts. First, our vast production resources are not used at any approach to capacity; second, we do not produce at capacity because we fear we cannot sell the goods at prices which will make continued production possible; third, we cannot sell the goods because the consumer does not have a sufficient income; fourth, the consumer does not have sufficient income to buy because the manufacturing processes do not allow a money profit sufficient for the consumer to buy the goods, and the people, under the impelling necessity of saving, cannot spend even as much money as they receive; and fifth, since business can be prosperous only when there are buyers, and since our present system limits both the number of buyers and their capacity to purchase goods, then the solution of the problem lies in an adequate income to the consumer, which in addition to what he may save will allow him to buy all the finished products as rapidly as they are put on sale. In the development of this theory are included discussions of installment buying, with its pros and cons; how capital growth provides buyers, stabilizing the dollar, and whether high wages, low prices, and mass production can offer any suggestion toward a solution of the problem.

The book is written in a free and easy style, interesting and yet leaving in the mind of the reader very definite points as to the present status and possible solution of the vital economic problems in American and business industry. R. M. DAVIS.

Year Book of the American Bureau of Metal Statistics. Seventh Annual Edition, 1926. By W. R. Ingalls, Director of the Bureau. 115 Broadway, New York City. Price, $2.

Statistics have a reputation for being dry and dull; perhaps most of them are. Mr. Ingalls and his staff, however, turn out a 112-page book that to us is fully as interesting as any printed matter that comes to the office. Necessarily many of the figures included in so comprehensive a book are a compilation of data originally collected by other agencies. The skill with which these data are interpreted and combined is an important element in the value of the result. Anyone can collect a lot of published figures and add them up; but more than this has gone into the present work. One of the difficulties faced by the reviewer of a book that comes out every year is that most of the good things that it deserves already have been said. It is not exaggerating to aver that this is the most valuable statistical publication regarding the non-ferrous metals that the world produces.

Stream Pollution—"Typical Methods and Devices for Handling Oil-Contaminated Water From Ships and Industrial Plants" is the subject of U. S. Bureau of Mines Technical Paper 385, pp. 66, by F. W. Lane, A. D. Bauer, H. F. Fisher, and P. N. Harding. The paper may be of some interest to mine and mill managers who face the problem of stream pollution, though the paper is written from a different point of view The price of the bulletin is 15c. and it may be obtained from the Superintendent of Documents, Washington, D. C.

Surface Tension—The U. S. Bureau of Standards recently published a bulletin which presents a brief survey of the methods used to measure surface tension; indicates the errors frequently made; and gives numerous working equations. A bibliography is appended. The bulletin is entitled "Measurement of Surface Tension," is by N. Ernest Dorsey, and may be obtained from the Superintendent of Documents, Washington, D. C., for 15c.

Selenium—The New York Public Library, New York City, has recently issued a comprehensive bibliography on the subject of selenium, covering references to the literature extending from 1817 to 1925. The compilation is by Marion Foster Doty. All of the references named may be consulted at the library, 5th Ave. and 42d St., N. Y. Many are in foreign languages. Copies of the bibliography, pp. 114, are obtainable for 65c.

Hydraulic Mining in California—The report of the Hydraulic Mining Commission upon the feasibility of the resumption of hydraulic mining in California is now available (pp. 85, with map). Requests may be addressed to the California State Mining Bureau, San Francisco.

Dust Respirators—"Dust Respirators: Their Construction and Fltering Efficiency" is the title of Technical Paper 394, recently issued by the U. S. Bureau of Mines, pp. 52, the authors being S. H. Katz, G. W. Smith, and E. G. Meiter. The paper is on excellent discussion of this important subject and deserves wide circulation. It may be obtained for 15c. from the Superintendent of Documents, Washington, D. C.

Manitoba Mineral Resources—"The Mineral Resources of Southeastern Manitoba," a 55-page bulletin by J. S. De Lury, is obtainable on request from the Industrial Development Board of Manitoba, Winnipeg. The Rice Lake district, Oiseau River district, and the Boundary district are discussed.

Patents

Chromium—No. 16,598. April 19, 1927. Carl Hambuechen, St. Louis, Mo., assignor to Electro Metallurgical Co. A process of electro depositing chromium from a bath containing chromic acid.

Magnetic Separator—No. 1,625,257. April 19, 1927. Leif J. Ingolfsrud and William H. Soule, Conniston, Ontario, Canada. An endless-belt magnetic separator with the belt mounted to travel at a gradually increasing inclination sideways to its direction of motion.

Smelter Spout—No. 1,625,755. April 19, 1927. Louis H. Williams, Camas, Wash., and Ralph E. Watt, Ontonagon, Mich. A design for a smelter spout comprising a metallic outer section and and inner section of refractive material, with a water circulation chamber between the two sections.

Ammonium Nitrate—No. 1,625,807. April 26, 1927. Henry Howard, Cleveland, Ohio, assignor to The Grasselli Chemical Co., Cleveland, Ohio. A process of making ammonium nitrate involving the use of ammonia, ammonium nitrate and nitric acid solutions.

Rock Drill—No. 1,625,211. April 19, 1927. Edward P. Jones, Breckenridge, Colo. Design for an electric-driven rock drill and automatic hammer and boring machine.

Rock Drill—No. 1,626,087. April 26, 1927. Charles A. Hultquist, Los Angeles, Calif. A design for a fluid operated percussive tool.

Rock Drilling Device—No. 1,626,277. April 26, 1927. Elmer G. Gartin, Claremont, N. H., assignor to Sullivan Machinery Co. External fluid supply connections for a rock-drilling mechanism.

Metal Pouring—No. 1,626,342. April 26, 1927. James E. Hurst and Edmund B. Ball, Kilmarnock, Scotland, assignors to Centrifugal Castings, Ltd., Scotland. A design for a metal-pouring apparatus for centrifugal casting machines.

Pig - Lead Truck — No. 1,626,350. April 26, 1927. William E. Newnam, Collinsville, Ill., assignor to National Lead Co., Jersey City, N. J. A design for a motorized pig-lead truck.

Breaker—No. 1,626,535. April 26, 1927. Ralph Hush, Johannesburg, Transvaal, South Africa. A design for a machine for breaking ore and other similar materials.

Personal Notes

Dr. Charles Henry White, of San Francisco, is in New York.

Lloyd T. Emory has returned to Philadelphia from a trip to Sonora, Mexico.

Carl J. Trauerman, mining engineer of Butte, Mont., will soon make a trip to Chicago, Boston, and New York.

Colin Johnston has been appointed engineer in charge of the Goudreau gold mine, in the Goudreau mining area of northern Ontario.

Arthur French, late president of the Transvaal Chamber of Mines, with his daughter, Miss D. French, has left Johannesburg, on a visit to England.

D. W. Rossiter, of the New Consolidated Gold Fields, Ltd., accompanied by his wife and son, has left Johannesburg on a six months' trip to England.

Frederick Laist, with Mrs. Laist and their son "Jim," sailed from New York on the "Homeric" on June 11 for a two months' pleasure and business trip to Europe.

George Glendenning, mining engineer of Toronto, has returned from an inspection of several properties in the Rice Lake area of Manitoba on behalf of Eastern financial interests.

Donald A. Callahan, of Wallace, Idaho, president of the Callahan Lead-Zinc Co., accompanied by Mrs. Callahan, is in Chicago and will also visit Galena, Ill., his former home.

Marshall W. Tuthill, of New York, has been chosen to fill the office of chief of the minerals division of the U. S. Department of Commerce. He will assume his duties July 1. At present Mr. Tuthill is a member of the New York staff of Tennant & Sons.

Dr. J. A. Bancroft, who was till recently professor of geology in the McGill University, Montreal, has arrived in Capetown, with Mrs. Bancroft, en route to Broken Hill, to join the technical staff as consulting geologist to the Anglo-American Corporation.

Raymond Brooks will be married to Mrs. Allan B. Forbes on June 28. Mrs. Forbes is a daughter of Mrs. Walter Craig Hately, of 30 Fifth Ave., New York City. Mr. Forbes died in 1923. He was chairman of the board of the banking and bond house of Harris, Forbes & Co.

Frederic K. Brunton received on June 1 his diploma of administrative engineer of mines from the University of Arizona, Tucson, Ariz. This course was given under the supervision of **Dr. E. P. Mathewson**, and has covered most successfully a new field in post-graduate work.

Erasmus Stephanus Jacobs, who found the first South African diamond, sixty years ago, is living in poor circumstances near Belmont, Cape Province. The Mayor of Kimberley has opened a fund with a subscription of five guineas in recognition of the services of one whose discovery changed the current of history in the sub-continent.

E. S. Moore, professor of economic geology, University of Toronto, has just completed a trip of ten days through the Sudbury, Cobalt, Kirkland Lake, and Porcupine camps with a party of students in connection with the economic geology work of the department of geology.

T. A. Rickard

T. A. Rickard received the honorary degree of Doctor of Science at the recent commencement exercises of the Colorado School of Mines.

S. L. Gillan, chairman of the Southern California Section of the American Institute of Mining and Metallurgical Engineers, recently returned to Los Angeles from a mine examination trip in Ouray County, Colo. In order to attend the joint meeting of the San Francisco and Southern California sections of the Institute, it was necessary to return to California more rapidly than the railroads could carry him, so he availed himself of the service rendered by the Western Air Express and made the trip from Salt Lake City to Los Angeles in five hours and ten minutes. Mr. Gillan says that any engineer who makes this trip and is familiar with the interesting desert country on this air route will feel well repaid by the bird's-eye view which he gets of the various mining camps and mineralized areas.

R. S. Handy, of Kellogg, Idaho, superintendent of mills for the Bunker Hill & Sullivan Mining & Concentrating Co., will leave Kellogg soon for Oruro, Bolivia, having been granted temporary absence by the Bunker Hill company. Mr. Handy has been engaged by the Patiño Mines and Enterprises Consolidated, one of the world's largest producers of tin, to remodel and modernize its mill, the present capacity of which is 800 tons daily. The mine and mill are situated at Llallagua, 50 miles from Oruro, with which it is connected by a railroad owned by the Patiño company. Llallagua is in the heart of the Andes Mountains at an elevation of 12,300 feet above sea level. Mr. Handy will be accompanied by his son, Raymond, now a student at the University of Idaho. From New York they will proceed by steamship to Antofagasta, Chile, and from there by rail to Oruro.

Obituary

John Nash, who, because of the fortune which he amassed in the early days in Colorado, was known as the "Silver King of North America," died in Seward, Alaska, early this month. Nash prospected until his legs were frozen in a gold rush near Nome, necessitating amputation below the knee. His active days over, he conducted a cigar store until the end.

William George Holford died recently at his residence in Johannesburg, aged sixty. He was born at Grahamstown and first came to the Rand in 1888. In the early days he was associated with the Farrar group of mines and, later, became consulting engineer to the Anglo-French group. In the South African War he served as captain in the South African Light Horse. He leaves a widow and two sons.

Saville Burdett Dowling died recently in Johannesburg, after a long illness. He was born in 1855, in Mississippi, U. S. A., and was educated at Trinity College, Dublin. He took part in the Galeka War and was a captain, in the Diamond Fields Horse, in Sir Charles Warren's campaign in Bechuanaland in 1884. He came to Johannesburg from Kimberley in 1889 and became a director of the West Rand Proprietary and the Heidelberg Platkop State. He was also secretary to various Johannesburg companies.

Edwin B. States, an aged mining prospector, was found dead in his cabin recently in the hills above Erie, B. C. He had had an adventurous career, some years of which were spent in South America, where he acquired a large fortune in mining ventures in Peru, Ecuador, and Central America. He left the tropics on account of ill-health and lost the greater part of his gains through insurrectionary troubles. He invested the remainder of his funds in Florida real estate, the income from which enabled him to finance his mining ventures in British Columbia, to which province he came in 1910. Mr. States owned a number of prospects in the Salmon Valley, B. C.

Thomas E. Hardy, one of the old guard mining engineers of Sonora, Mexico, was murdered at his mine, Banco de la Tuna, on May 21. Details of the tragedy are not known. T. E. ("Tommy") Hardy was born in Australia sixty-two years ago. He was a pioneer of Coolgardie, Kalgoorlie, and other sensational Australian gold rushes. He was also at one time employed by Broken Hill Proprietary in Broken Hill, N. S. W., Australia. Hardy some twenty years ago was general manager of the United Gold Mines of West Africa, where, through his economy and efficiency, the mines of this company were brought to a dividend paying basis. On leaving West Africa on account of continued malaria attacks he accepted a position as manager of the Mining Bureau of Manila, P. I., where he was greatly praised for his efficiency and results he achieved in the islands. He was highly esteemed by both Mexicans and foreigners in Mexico. Hardy was a widower and leaves a daughter, who is at college in England.

Market and Financial News

Increase in Production Outstrips Growth in Population

Conference Board Statistics Show Output per Wage Earner Has Advanced 35 per Cent in Twelve Years

THE total manufacturing production in the United States has increased about 65 per cent in volume from 1914 to 1925, or at a rate about 3½ times as fast as the population, which has increased less than 18 per cent during the same period, according to a study just completed by the National Industrial Conference Board. Production of our manufacturing industries per wage earner employed in 1925 was 35 per cent, or more than a third, greater than in 1914, volume of production having far outstripped the increase in the number of workers as well as population growth.

In these figures, in the view of the Conference Board, lies the chief explanation for the unparalleled growth of our national wealth and income and our national business prosperity, which rests primarily on the rising productive and purchasing power of the American wage-earning population. "Real wages," —that is, the weekly earnings of industrial workers as measured by living costs—since 1914 have increased about 33 per cent, while the "real" national income, as measured in dollars of constant purchasing power, has increased about 28 per cent, indicating that the wage earner during that period has shared the increase in income at about the same rate as is recorded for the nation as a whole.

"The progress of the manufacturing industries of the United States during the first quarter of the century," declares Magnus W. Alexander, president of the Conference Board, "has been a striking demonstration of the economic principle first enunciated by Adam Smith, that the wealth of nations consists not in the unconsumable riches of money, but in the consumable goods annually produced by the labor of society. The total volume of our manufacturing production from 1899 to 1925 increased 180 per cent, or nearly doubled. Our 'real' national wealth during that time also about doubled, and our national income, in terms of dollars of constant purchasing power, more than doubled. But it has been the steady increase in efficiency of production and in 'real wages' since 1914 that have been the most fortunate development, as they have created the chief market for our immensely increased production."

Technical improvements, increased managerial efficiency, including above all the much increased use of mechanical power, the board declares, in the main have been responsible for the increasing productivity of our industries. In 1925 there was 32 per cent, or nearly a third, more installed power back of every factory worker in the United States than there had been in 1914. The greater amount of production thus turned out per worker employed, the board points out, has made possible the maintenance of a high wage level during a period of declining prices, an anomaly in the light of previous experience, which has puzzled economists and business men both in America and abroad.

Statistical Notes

Granby Consolidated Copper bonds have been converted into stock at a rapid rate following the declaration of a quarterly dividend of $1. It is said on good authority that upward of $500,000 of these 7 per cent bonds have been converted, bringing the total still outstanding to less than $2,000,000. Bonds are convertible into stock at any time on a basis of four shares for each $100 in bonds. The return, assuming Granby stock to be on a $4 annual dividend basis, is 16 per cent on par value, against 7 per cent return on the bonds. There is thus strong incentive for conversion by those who wish to get the next dividend, which is payable July 1 to stock of record June 15. A few years ago Granby had bank loans of about $6,000,000, all of which have been liquidated. It also formerly had $4,000,000 6 per cent mortgage convertible bonds outstanding, conversion privilege on which expired May 1, 1923. This issue has been cut down to $800,000, and the company is buying in these bonds in advance of maturity date whenever they are offered. With steady conversion of the present 7s, it is figured that by the end of this year Granby may have no bonds whatever outstanding, and it is also figured that it will have quick assets $3,000,000 in excess of quick liabilities. Earnings last year were $5.41 per share, but this cannot be duplicated unless the copper market takes a sudden and substantial upturn.

Hecla Mining Co. reports for the quarter ended March 31 net profit of $556,039 after taxes and depreciation, This compares with $538,104 in the preceding quarter and $581,571, or 58c. a share, in first quarter of 1926 Gross income was $1,146,502, compared with $1,192,866 in the preceding quarter. The following are comparative production figures:

	Fourth Quarter 1926	First Quarter 1927
Tons mined	87,943	85,980
Pounds lead produced	15,291,735	17,064,285
Average lead price, cents	7.83	7.38
Ounces silver produced	442,967	507,115
Average silver price, cents	55	56

Chief Consolidated Mining Co. for the first quarter of 1927 reports an operating profit of $17,006 on the sale of $447,930 worth of ore, concentrates, and lime products. After crediting miscellaneous income and debiting bond interest the net to surplus was $9,306. Lower average prices for metals and the unexpected faulting and loss of the ore on the lower levels are assigned as the principal reasons for the bad showing. The accompanying tables summarize operations for the quarter:

Classified Tonnage

Silver-lead ores to smelter	14,066
Dry ores to smelter	4,791
Zinc-lead ores to smelter	244
Silver-lead ores to concentrator	2,394
Dry ores to concentrator	355
Zinc-lead ores to concentrator	4,001
	25,851

Metal Contents

Gold, oz.	2,127
Silver, oz.	455,059
Lead in lead ores, lb.	4,913,371
Copper in copper ores, lb.	139,363
Lead in zinc-lead ores, lb.	532,500
Zinc in zinc-lead ores, lb.	1,029,229

Net Returns

	Zinc-Lead Ores	Lead and Dry Ores
Average gross value, per ton	$30.23	$31.00
Smelting, freight and sampling, per ton	24.65	14.57
Average net values	$5.58	$16.43

Frontino and Bolivia Gold Mining Co. during the year ended June 30, 1926, produced 23,363 oz. of gold and 17,111 oz. of silver from 27,780 tons of ore. Output was slightly less than the year before. Ore reserves at the end of the year are estimated at 52,900 tons, with an average grade of 16.5 dwt. per ton. This compared with an average yield of 16.82 dwt. in 1926. Balance carried down to profit was £10,421 from sales of bullion amounting to about £100,000.

Copper Range Co. during the year 1926 realized an operating profit of $499,103 from the mining and treatment of 417,321 tons of ore. The cost per pound of copper, including depreciation and depletion, was 16.97c.; and the price received was 13.94c. The following table summarizes results:

Gross Income

Copper sold, 17,570,967 lb., and delivered at average of 14.161c. per lb.	$2,488,223
Copper on hand, 5,955,310 lb., at average sales price of 13.322c. per lb.	793,364
Copper produced, 23,526,277 lb., at average of 13.949c. per lb.	$3,281,588
Copper Range Railroad operating revenue	960,154
Interest	191,439
Total	$4,433,182

Deductions

Mining expense, smelting, freight, taxes, selling and general expenses	$2,869,515
Copper Range Railroad operating charges, taxes, and other debits	766,042
One-half Champion profits	298,521
Total	$3,934,079
Operating profits	$499,103
Interest on Copper Range Railroad bonds	114,000
Net income	$385,103
Depletion and depreciation	591,913
Deficit	$206,810

The Market Report

Heavy Sales of Lead at Better Prices—Zinc Also in Demand and Higher—Copper Neglected

New York, June 8, 1927—Not in months has the lead market been so active as during the last week, practically all producers reporting an unusual demand. Total sales of zinc, too, have been unusually large, and prices have advanced another 20 points. Prompt tin advanced a little, with reasonably good demand. Silver is slightly lower than a week ago, and copper has practically marked time, with little activity by either sellers or buyers. It is generally felt that the recent rate of decline in commodity prices is not likely to continue and that the increased firmness in metal prices is more than a flash in the pan.

Copper Market Quiet

Copper sales have not amounted to anything all week, but prices have held well in view of the exceedingly meager business. A little copper was sold at 12⅝c., delivered, last Thursday, but since then the level has been 12¾c., with 12⅞c. and as high as 13c. secured in the Middle West. Two or three producers are unwilling to sell at less than 12⅞c., delivered in the East, but today as low as 12.70c. was done. The sheet business seems to be the most active among the various manufactured copper products. Export sales of copper were excellent on Thursday, and very good also on Friday, when the export association advanced the price from 13 to 13.10c., c.i.f. Since then the foreign market has been dull, perhaps chiefly owing to the Whitsuntide holidays.

Extraordinary Activity in Lead

The domestic lead market suddenly and rather unexpectedly came to life late Wednesday afternoon, a week ago. Since then buying, principally for June and July, has been exceptionally active, with no decisive let-up apparent as yet. Just what started the movement is not easy to explain. Future lead in the London market made three successive advances on Wednesday, Thursday, and Friday, and this may have helped convince domestic consumers that the bottom of the decline had been reached. It is likely that many buyers had meager stocks on hand and that they felt they could not lose much and might gain considerable by buying for July delivery at current prices. There does not appear to be any great improvement in the fundamental situation with respect either to production or consumption, and it is probably for this reason that the American Smelting & Refining Co. has not increased its official contract price in New York from 6.40c., even though most of the business was done at 6.45c. and 6.50c. The most active buying took place in the Middle West, the leading interest there being a free seller at prices advanced only moderately on successive days. All of the principal consuming industries are represented among the buyers, in spite of the fact that one of the largest factors in each of the three leading industries—paint, storage battery and lead-covered cable—foresee smaller demand for their products than was expected a few months ago. An encouraging feature is that the London market remains sufficiently high to absorb Mexican ore lead.

Zinc Up to 6.30c.

Sales of zinc in the week ending today have been the best in many weeks, last Thursday being an especially active day. Dealers have been prominent among the buyers, but consumers have taken good tonnages also. Demand has been stimulated by the upward trend in prices, as is usual. The London market has advanced proportionately the same amount as has the St. Louis market in the last two weeks. Spot lots of High-Grade are nominally unchanged at 8c. per lb.

Tin Market Steady

The tin market has been comparatively quiet, with prices firmer, because of the limited supply of prompt metal on hand. This applies especially to Straits, which commands a premium of about 4c. over 99 per cent; likewise, the prompt position enjoys an advantage of 3½c. to 3¾c. over futures.

Silver Slightly Lower at 56¾c.

The silver market is quiet, with a somewhat easier tendency, the chief support coming from China. Demand

Daily Prices of Metals

June	Copper	Tin		Lead		Zinc
	Electrolytic, N Y	99 Per Cent	Straits	N Y	St L	St L
2	12 50	63 625	68 00	6.45	6 10@6 15	6 20
3	12 55	64 125	68 125	6.45@6 50	6 15	6 225@6 25
4	12 55	64 00	68 125	6 45@6 50	6 15	6 25
6	12.55	64 00	68.00	6.45@6 50	6 175-6.225	6 25
7	12 525	64 00	68 125	6.40@6 45	6 175@6 20	6 25@6 30
8	12.475	64 00	68 00	6 40@6.45	6.175@6.20	6.275@6 30
	12.525	63 958	68 063	6 454	6 167	6 250

Average prices for calendar week ending June 4, 1927, are: Copper, 12.500c.; 99 per cent tin, 63.650c.; Straits, 67.725c.; N. Y. lead, 6.440c.; St. L. lead, 6.105c.; zinc, 6.178c.; and silver, 57.100c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
2	54 7/16	55 1/8	60	292 3/4	286 1/4	25 3/16	25 1/2	28 7/8	28 15/16
3	54 13/16	55 3/4	60 1/4	295 7/8	288 5/8	25 3/4	25 11/16	28 13/16	28 7/8
6	Holiday	.....	.....	.....	.....	.....	.....	.....	.....
7	54 11/16	55 5/16	60 1/4	295 1/2	288 3/4	25 5/16	25 5/8	28 7/8	28 15/16
8	54 3/16	54 13/16	60 1/4	295 5/8	288 3/4	25 1/16	25 3/8	29	29 1/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
2	4.85 1/4	57 1/4	26 1/2	84s11½d	6	4 85 3/16	57 1/8	Holiday	.....
3	4.85 1/8	57 1/4	26 7/16	84s11½d	7	4 85 1/4	56 3/4	26 3/8	84s11¾d
4	4 85 1/8	57	26 3/8	.....	8	4 85 3/16	56 3/4	26 3/16	84s11¾d
					Avg.		57 021		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

from India has fallen off, and the closing tendency is quiet and uncertain.

Mexican Dollars (Old Mexican pesos): June 2d and 3d, 43⅛c.; 4th, 43¼c.; 6th, 43⅜c.; 7th and 8th, 43⅛c.

Foreign Exchange Steady

Closing cable quotations for principal foreign exchanges on Tuesday, June 7, were: francs 3.91⅝c.; lire, 5.50½c.; and marks, 23.695c. Canadian dollars are at par.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c. London, 98 per cent, £104@£106 per long ton for domestic consumption. Heavy imports unsettle British market.

Antimony—Per lb., duty paid, New York: Chinese brands, range for the week, spot business at 12⅞@12⅝c. July arrival about ⅛c. higher. Cookson's "C" grade, spot, 18c. Market dull. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

Bismuth—Per lb., New York, in ton lots, $2.20@$2.25. London, 8s.

Cadmium—Per lb., New York, 60c. London, 1s. 10d. for Australian metal.

Iridium—Per oz., $107@$112 for 98 @99 per cent sponge and powder.

Nickel—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal. London, £170@£175 per long ton, according to quantity.

Palladium—Per oz., $54@$56. Small lots bring up to $60. Pure metal as a constituent of crude platinum, nominal.

Platinum—Official price quoted by the leading interest on small miscellaneous orders for refined metal, $72. Price reduced from $80 on June 1. This change was not reported to us until too late to be recorded in the issue of June 4. Open market cash sales of large lots, in New York, $66@$68. Pure metal as a constituent of crude platinum, nominal at $62.

London, £14½ per oz. for refined and £13½ for crude. Nominal.

Quicksilver—Per 75-lb. flask, $120@ $122. Dull and easier. San Francisco, $118. London, £22¾@£23.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the issue of June 4.

Zinc Blende Price Advanced—Lead Ore Unchanged

Joplin, Mo., June 4, 1927

Blende	Per Ton
High	$42.90
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	39.00
Fines and slimes, 60 per cent zinc	38.00@ 36.00
Average settling price, all zinc	36.16
Galena	
High	$83.30
Basis 80 per cent lead	78.00
Average settling price, all lead	82.05

Shipments for the week: Blende, 7,486; lead, 1,839 tons. Value of shipments for the week, $421,580.

The low average selling price is created by the continued sale of the lower grade of ores, while the better grades are withheld from the market. Slab zinc is due for some rapid advances, viewing the outlook from the angle of this district. Smelters have shipped 75,000 tons less zinc concentrate from this district the first five months of this year than during the same period of last year, an apparent restriction of more than 65,000 tons of slab zinc. It is doubtful if actual needs have declined that much, though demand has been restricted by hand-to-mouth buying of slab zinc to an inordinately low level. Holders of approximately 80 per cent of the 33,000 tons of visible stock in this district are demanding a $45 basis for the concentrate. Lead prices were not lowered this week, and a number of sellers declined that price; they expect to see a return to $90 to $100 a ton before the end of September.

Platteville, Wis., June 4, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$40.75
Lead Ore	
Lead, basis 80 per cent lead	$80.00

Shipments for the week: Blende, 1,228 tons; lead, 40 tons. Shipments for the year: Blende, 28,809; lead, 840 tons. Shipments for the week to separating plants, 1,966 tons blende.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@ 40c. Business dull. Chemical grades unchanged from quotations in the June 4 issue.

Tungsten Ore—Per unit of WO_3, N. Y.; Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25. Dull; prices largely nominal.

Chrome, Iron, Molydenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the June 4 issue

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the June 4 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3¾c. per lb. Quiet. London, Cornish white, per long ton, £16.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate and **Zinc Oxide** are unchanged from prices in the June 4 issue.

Ferro-Alloys

Ferrochrome—Per lb. of contained chromium, 60@70 per cent chromium, 4@6 per cent carbon, 11½c.

Ferromanganese—Domestic and foreign, 78@82 per cent, $90 per long ton, furnace or duty paid, for delivery during first half of 1927. Spiegeleisen, 19@21 per cent, $36@$37, f.o.b. furnace; 16@19 per cent, $34.

Ferrotungsten—$0.98@$1 per lb. of W contained, f.o.b. works. Market spotty.

Ferrocerium, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the June 4 issue.

Metal Products

Rolled Copper—Sheets, 21½c.; wire, 14⅝@14¾c. f.o.b. mill.

Lead Sheets—Full rolled, 10c. per lb.; clipped, 10¼c.

Nickel Silver—28¾c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 18¾c. per lb.; rods, 15¾c.

Zinc Sheets—9¾c. per lb., f.o.b. mill.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and **Zirkite** are unchanged from quotations in the June 4 issue.

Steel Mills Continue Active

Prices Hold Well—Pig Iron and Coke Dull

Pittsburgh, June 7, 1927

The steel market continues to be characterized by a multitude of small orders for very prompt shipment, rather than by large orders of outstanding individual importance, the net result being that mill operations are well sustained, having had since March no more than the mild decrease that occurred in the same period a year ago.

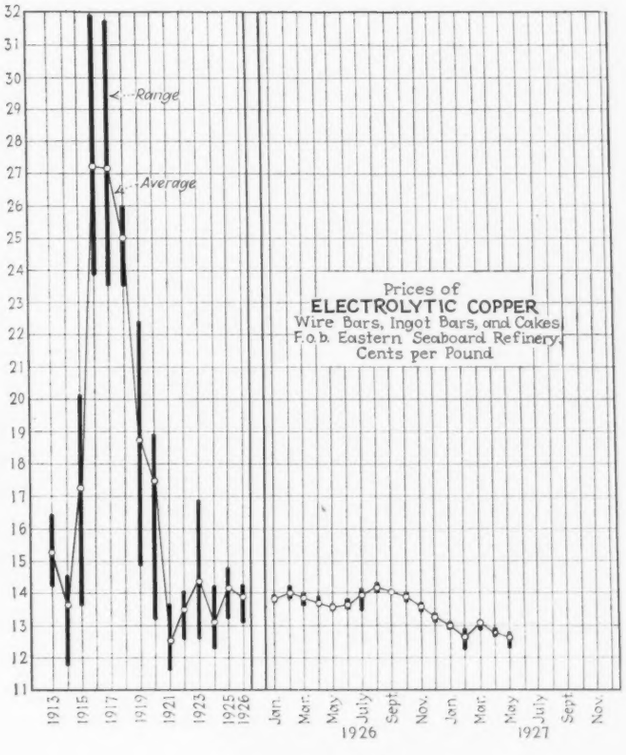
Steel prices have been holding better than would have been expected from the irregularities observed for more than two months, and there is no open-market decline. In bars, shapes, and plates the Eastern market has been particularly irregular, while in wire products there has been softness in various districts. In sheets the advanced asking prices put out in the last five or six weeks are holding well, at 2.25c. for blue annealed, 3.00c. for black, 3.85c. for galvanized, and 4.25c. for automobile sheets, and in the latter no little July tonnage has already been sold.

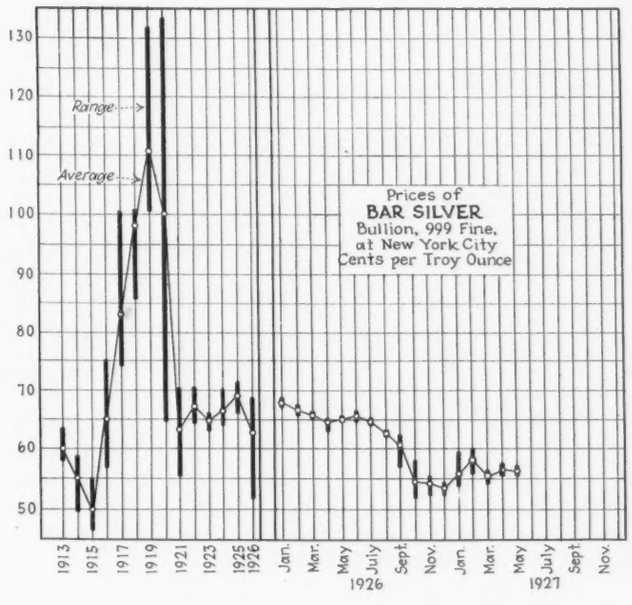
Steel production is at between 80 and 85 per cent of assumed capacity and it is doubtful whether even July will show a rate as low as 75 per cent. For three successive years there has been an upturn after July.

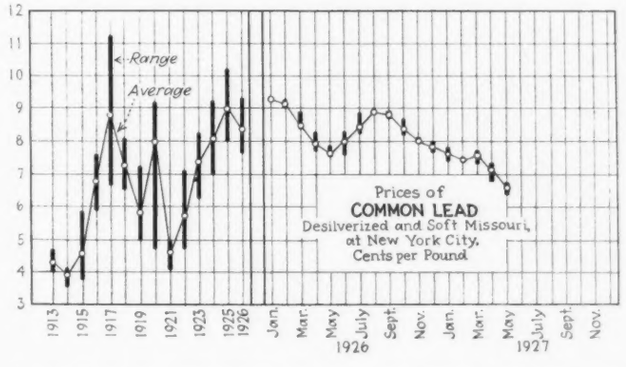
Pig Iron.—The Valley market remains stagnant, but a moderate amount of buying is expected before the end of the month. Bessemer, $19; basic, $18; foundry, $18.50, f. o. b. furnace.

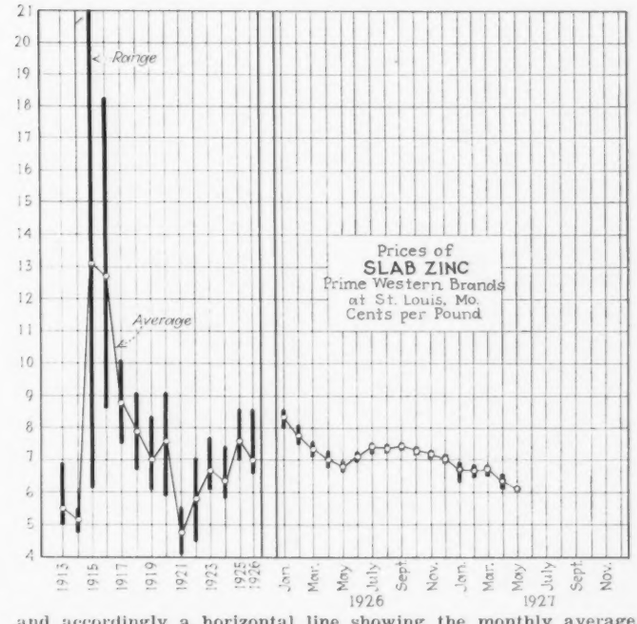
Connellsville Coke.—The spot market remains weak at $2.85@$3 for furnace and $4@$4.75 for foundry. Producers and furnacemen are far apart as to third-quarter contracts, having, roughly speaking, to bridge a gap between $3 and $3.50.

Metal Price Curves

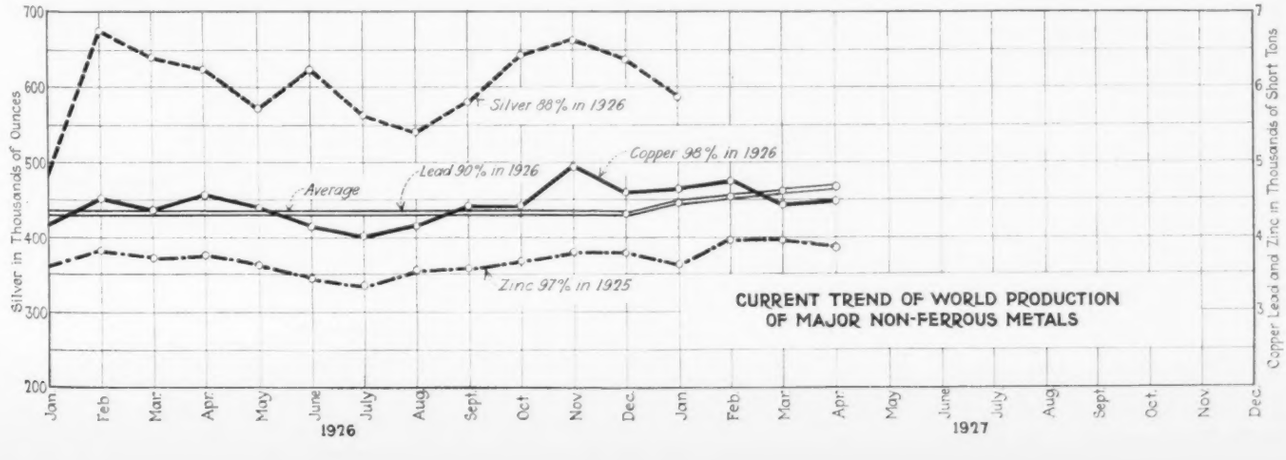




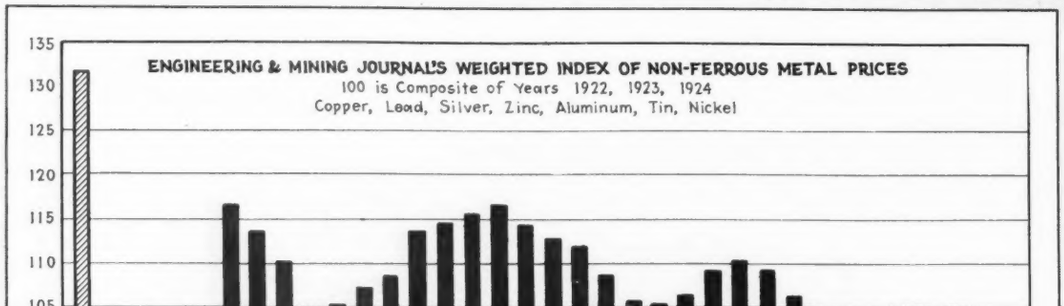


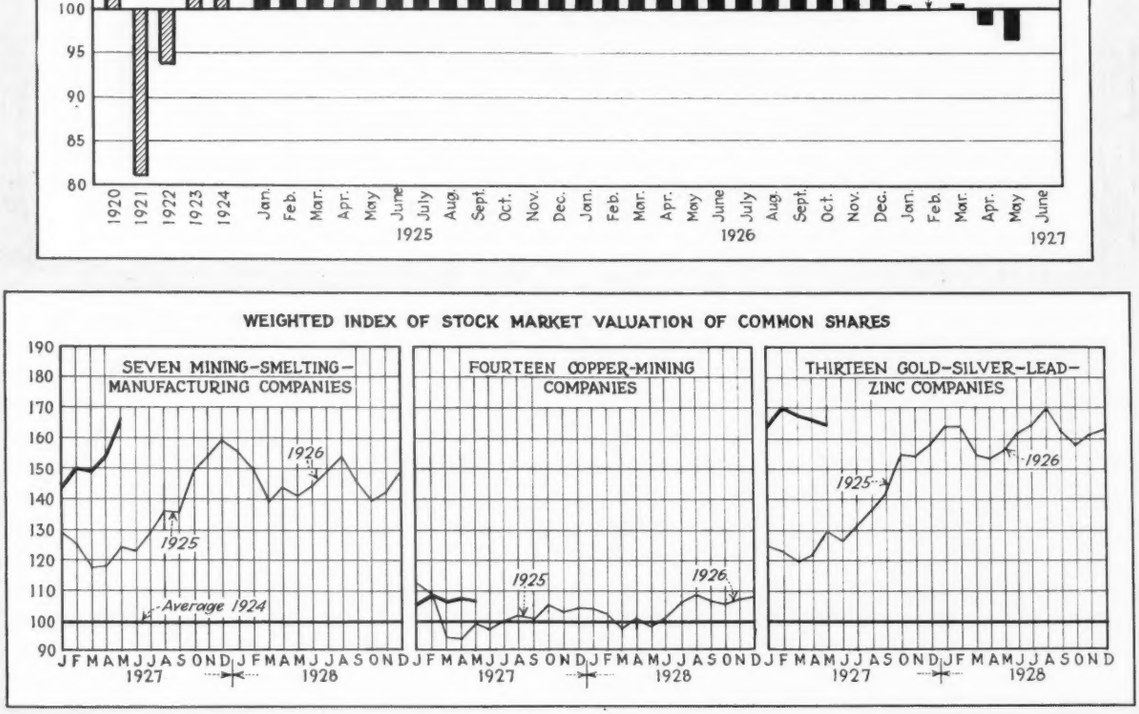


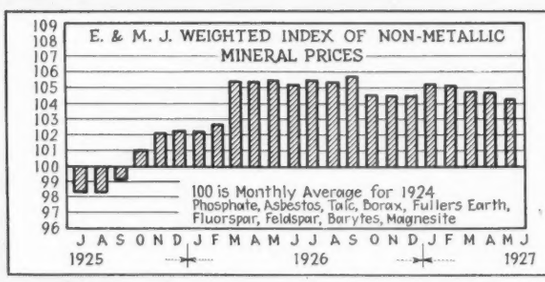
THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926; and accordingly a horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.

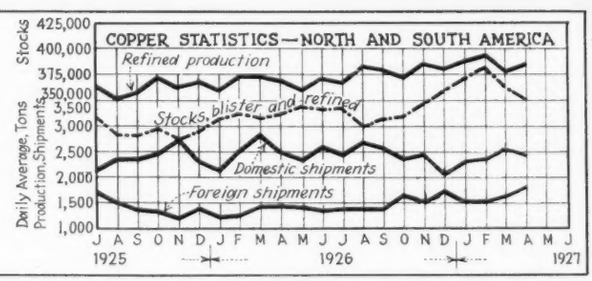


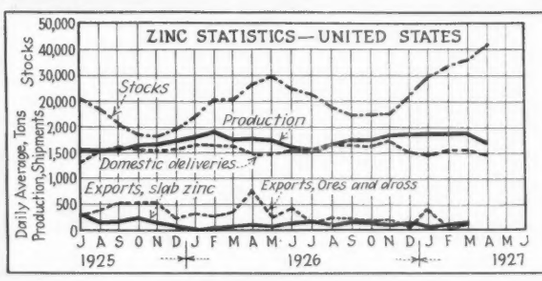
E.&M.J. Statistics of the Mining Industries

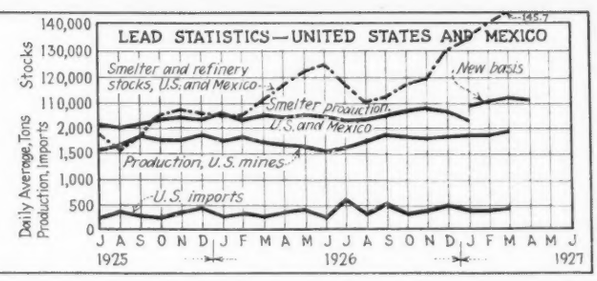

ENGINEERING & MINING JOURNAL'S WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is Composite of Years 1922, 1923, 1924
Copper, Lead, Silver, Zinc, Aluminum, Tin, Nickel
100.01
1920 1921 1922 1923 1924 Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June
1925
1926
1927


WEIGHTED INDEX OF STOCK MARKET VALUATION OF COMMON SHARES
SEVEN MINING-SMELTING-MANUFACTURING COMPANIES
FOURTEEN COPPER-MINING COMPANIES
THIRTEEN GOLD-SILVER-LEAD-ZINC COMPANIES
1925
1926
Average 1924
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1927
1928


E. & M. J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth, Fluorspar, Feldspar, Barytes, Magnesite
J A S O N D J F M A M J J A S O N D J F M A M J
1925
1926
1927


COPPER STATISTICS—NORTH AND SOUTH AMERICA
Stocks
Daily Average, Tons Production, Shipments
Refined production
Stocks, blister and refined
Domestic shipments
Foreign shipments
J A S O N D J F M A M J J A S O N D J F M A M J
1925
1926
1927




LEAD STATISTICS—UNITED STATES AND MEXICO
Stocks
Daily Average, Tons Production, Imports
Smelter and refinery stocks, U.S. and Mexico
New basis
Smelter production, U.S. and Mexico
Production, U.S. mines
U.S. imports
J A S O N D J F M A M J J A S O N D J F M A M J
1925
1926
1927

Review of Current Statistics

A. B. Parsons
Associate Editor.

FROM the standpoint of income and profits to companies producing non-ferrous metals, the statistical picture at the moment is not favorable. During May, the average price for each of the major metals—copper, lead, and zinc—reached a lower level than at any time since 1924. This brought the *Engineering and Mining Journal's* Weighted Index of Non-Ferrous Metal Prices down to 96.41, extending a decline that has continued steadily since August, 1926, except for a minute increase in March.

The average for the first five months of 1927 is only 99.27, compared with 108.98 in the corresponding period of 1926 and 106.44 in the last five months of 1926. The most discouraging feature of course is the fact that the monthly trend has been downward. One cannot fail to recognize the fact that the comparatively satisfactory annual reports of mining company finances in 1926 will not be duplicated in 1927 unless a prompt and decisive change in the position of the metal markets takes place. And he must be optimistic indeed who foresees such a change of sufficient moment to offset the five months of low prices. There are of course many mining companies favored with low costs that will continue to earn excellent profits at present prices for metals. However, a difference of 1c. per pound in the price of copper—the average for the first five months of 1927 was 12.83c. against 13.80c. for the year 1926; and of 1.15c. in the price of lead—the corresponding figures are 7.26c. and 8.41—is sure to cut into the earnings of the best of them. This is reflected in the most recent quarterly reports; and is likely to be more evident in the reports for the second quarter.

What, if anything, is there of an optimistic tinge in the situation? In the first place metal prices are not alone in the decline. The trend of the general commodity level likewise has been downward, though not nearly so precipitately, in the last two months. As has been pointed out in this department many times, lower commodity prices ultimately should be reflected in lower operating costs.

Second, the troughs in the index curve, as shown on the opposite page, have bottomed either in April or May. If there be any potency in seasonal influences, some improvement may be looked for in the summer and autumn.

Third, some evidence of curtailment in production is at hand, though it is rather difficult to measure accurately. The graphs disclose some decline in stocks of blister and refined copper, but the decline in production, both refined in North and South America and blister in the world, that started in March did not continue in April. May figures are awaited with great interest.

Zinc production was smaller in April, and the belief is general that further curtailment will be effected. The rapid climb since last November in the curve representing United States stocks indicates the need for such action on the part of producers.

More startling still is the upward trend of lead stocks in the United States and Mexican smelters and refineries. The figure actually has crowded out of bounds on the accompanying chart. Signs of curtailment in production are less tangible than in the instance either of copper or of zinc, but reports of decreased custom intake come from certain smelters in both the United States and Mexico. Likewise, curtailment is expected in Spain. Certainly the prevailing price level ought to discourage production on the part of marginal producers.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74

	1925	1926	1927
November	116.69	104.21	
December	114.15	102.31	
January	116.38	112.66	100.46
February	113.50	111.91	100.01
March	110.20	108.95	100.84
April	104.75	105.93	98.63
May	105.34	105.43	96.41
Average first five months	110.03	108.98	99.27

A fourth basis for optimism is the increased strength in the European markets. Evidence points to better consuming demand in Germany, Great Britain, and one or two other Continental countries. April shipments of copper to Europe were at a higher rate than at any time in the last two years, and buying during the last few weeks for foreign account has been unusually brisk. The accompanying table discloses some improvement in the foreign situation, according to data issued by the American Bureau of Metal Statistics.

Net Average Monthly Imports of Metals

In Metric Tons

Great Britain	1925	1926	Four Months 1927
Copper	11,245	8,527	9,927
Zinc	10,389	11,840	12,717
Lead	20,913	21,060	24,571
Germany	**1925**	**1926**	**Three Months 1927**
Copper	16,086	10,100	14,397
Zinc	6,925	6,288	6,889
Lead	10,201	6,340	8,163

Two small declines are to be noted among the non-metallic minerals: in feldspar and in barytes. The others are quotably unchanged. The net result is a decline in the *E. & M. J.* Weighted Index to 104.37 from 104.74. Only minor fluctuations have occurred in the past fifteen months.

In the face of the rather blue picture that has been painted, the sharp ascent of the index of mining-smelting-manufacturing shares seems rather anomalous. As a matter of fact the advance to 166.1, the highest point reached by the curve since it was started, is the consequence principally of the phenomenal advance in International Nickel Co., the shares of which recently have touched $75 and which closed the month of May above $71. The common shares outstanding number 1,673,000, so that including about 90,000 shares of preferred with a current market price of $105 the total stock valuation of about $130,000,000 is placed on the company. The share strength arises from the technical market situation rather than intrinsic worth of the properties. Just what interests are operating in the market is not known; but a New York group and the Canadian Pacific railway are mentioned as seeking control.

Next to International Nickel, American Smelting & Refining contributes most to the advance in the index. Reports of an increased dividend rate, and of a forthcoming stock dividend—the latter denied in semi-official quarters—doubtless contribute to the strength. Unquestionably current earnings are much less than they were during 1926, because of the lower prices for metals. The increasing output from its own mines, in Peru and particularly in Mexico, makes metal markets a more important factor in the smelting company's income than they were when custom ores comprised a greater proportion of the intake of the various smelting plants. Action in the matter of larger dividends probably will be deferred till toward the end of the year, when a better perspective of the situation can be obtained. New Jersey Zinc, National Lead, and Anaconda showed a small net advance during May.

With three exceptions—Kennecott, Granby, and Calumet & Arizona—the "coppers" in the group considered were off. Chile was the biggest factor in the decline, followed by Inspiration. The passing of its dividend naturally had a bad effect on Inspiration shares, though the policy of conserving its ore reserves instead of endeavoring to operate at maximum capacity in order to continue dividends ought in the long run to be in the shareholders' interests. The weakness in the market for the metal contributed to the decline in copper-share prices in the face of the general advance in the stock market.

A decline in the miscellaneous group also is shown, again counter to the general trend. Hollinger has eased slightly and likewise St. Joseph Lead. These two, because of their great size, are the largest factors in the index number, so that a small decline in the per-share quotations makes a much greater impression than a considerable decline in some of the smaller companies. Lake Shore, the Kirkland Lake gold property, reached $20.60 during the month, thereby putting itself into the $40,000,000 class—into company that few mines, indeed, have entered

Mining Stocks—Week Ended June 4, 1927

Stock	Exch.	High	Low	Last		Last	Div.
COPPER							
Anaconda	New York	46 1/4	45 1/4	45 1/4	Ap.16,May21	Q	0.75
Arcadian Consol.	Boston	*30	*30	*30			
Ariz. Com'l	Boston	6 1/4	5 1/2	6 1/4	Ja. 7, Ja. 28		0.50
Calaveras	N. Y. Curb	2 3/16	1 15/16	1 1/2			
Calumet & Arizona	New York	68	65	66	Ju. 13, Ju. 20	Q	1.50
Calumet & Hecla	Boston	15 1/4	15	15	My.31, Jn.15	Q	0.50
Cerro de Pasco	New York	60 1/2	59 3/4	60	Ap. 14, My. 2	Q	1.00
Chile Copper	New York	36 3/4	35 1/4	35 1/2	Jn.3, Jn.30,	Q	0.62 1/2
Con. Coppermines	N. Y. Curb	2 1/4	2 1/2	2 1/2			
Copper Range	Boston	13 1/4	12 1/2	13 1/4	Ap.2, My.2,	A	1.00
Crystal Copper	Boston Curb	*35	*30	*31			
East Butte	Boston	1 1/2	1 1/2	1 1/2	Dec., 1919		0.50
Granby Consol	New York	41 1/2	39 1/2	40	Jn.15 Jy. 1	Q	1.00
Greene-Cananea	New York	47 3/8	45 3/4	46 1/4	Nov., 1920		0.50
Howe Sound	New York	38	35 1/2	37	Apr.1,Apr.15	Q	1.00
Inspiration Consol	New York	15 1/4	14 1/2	15 1/2	Ma.17, Ap.4,	Q	0.25
Iron Cap	Boston Curb	*2 1/4	*2	*2 1/4			
Isle Royale	Boston	10	10	10	Fe.4, Fe.19,	Q	0.50
Kennecott	New York	65 3/8	63 1/4	63 1/4	Ju. 3, Jy. 1	Q	1.25
Magma Copper	New York	37 1/2	33 1/2	37 1/4	Ma.31,Ap.15,	Q	0.75
Mason Valley	N. Y. Curb	1 1/2	1 1/2	1 1/2			
Miami Copper	New York	15 1/4	14 1/2	15	My.2,My.16	Q	0.37 1/2
Mohawk	Boston	40	38 1/2	40	Ap.30, Jn.1	Q	1.00
Mother Lode Coal	New York	3 1/4	3 1/4	3 1/4	Jn.10, Jn.30		0.25
Nevada Consol	New York	14 1/4	14 1/4	14 1/2	Ma.17,Ma.31	Q	0.37 1/2
New Cornelia	Boston	21 1/2	21 1/2	21 1/2	My.6, My.23	Q	0.50
Noranda	N. Y. Curb	22 3/4	21 1/4	21 1/2			
North Butte	Boston	1 1/8	*99	1	Oct., 1918		0.25
Ohio Copper	N. Y. Curb	*67	*61	*64	Sept. 1926		0.03
Old Dominion	Boston	12	11 1/8	12	Dec., 1918		1.00
Phelps Dodge	N. Y. Curb	...	...	115	Ma.22, Apr.2	Q	1.50
Quincy	Boston	17	14 3/8	17	March, 1920		1.00
Ray Consolidated	New York	15 1/4	15	15 1/4	Ap.20, Ap. 30		0.25
St. Mary's Min. Ld.	Boston	22 1/2	21	21	Fe.10, Ma.10		2.00
Seneca Copper	New York	3 1/4	2 3/4	3			
Shattuck-Denn	Boston Curb	4 3/8	3 1/4	3 1/2			
Tenn. C. & C	New York	8 1/4	8 1/4	8 1/4	My.31,Ju.15,	Q	0.12 1/2
United Verde Ex	N. Y. Curb	23 7/8	23 1/2	23 1/4	Apr.6, May1	Q	0.75
Utah Copper	New York	115	115	115	Ma.17,Ma.31	Q	1.50
Utah Metal & T	Boston	1 1/4	1 1/8	1 1/8	Dec., 1917		0.30
Walker Mining	Salt Lake	*54	*50	*51			
NICKEL-COPPER							
Internat. Nickel	New York	75	68	70	Ma.17, Ma.31	Q	0.50
Internat. Nickel pfd.	New York	....	....	105	Ap.14,My.2	Q	1.50
LEAD							
Gladstone Mtn	Spokane	*24 1/2	*24	*24	April, 1927		0.005
National Lead	New York	106	95	104	Jn. 10,Jn.30	Q	1.25
National Lead pfd	New York	132 1/4	131 3/4	132 1/2	My.10,Jn.15	Q	1.75
St. Joseph Lead	New York	39 1/4	38 3/8	38 3/4	Se.10,Se.20,	QX	0.75
ZINC							
Am. Z. L. & S	New York	8	8	8	May, 1917		1.00
Am. Z. L. & S. pfd.	New York	46	45 1/4	45 1/4	Nov., 1920		1.50
Butte C. & Z	New York	4 3/4	4 1/4	4 3/4	De. 9, De. 24		0.50
Butte & Superior	New York	10 1/2	9	9	Ma.15,Ma.31	Q	0.50
Callahan Zn-Ld	New York	1 1/4	1 1/8	1 1/8	Dec., 1920		0.50
Consol.Lead&Zinc'A'	St. Louis	13 1/4	13	13	Ma.15, Ap.1	Q	0.25
Eagle-Picher	Cincinnati	28	27	27 1/2	Au.15,Se.1	Q	0.40
Eagle-Picher pfd	Cincinnati	...	...	116	Jn.30, Jy.15	Q	1.50
New Jersey Zn	N. Y. Curb	181	180	180	Jn.20, Jy.9	QX	2.00
United Zinc	N. Y. Curb	...	...	*55			
Yellow Pine	Los Angeles	*25	*20	*25	Dec. 1925	Q	0.04
GOLD							
Alaska Juneau	New York	...	...	1 3/8			
Argonaut	Toronto	*50 1/2	*41	*42 1/2			
Barry-Hollinger	Toronto	*40	*25	*39			
Consol W. Dome L.	Toronto	*6 1/4	*5 3/4	*6 1/8			
Cresson Consol. G	N. Y. Curb	2 1/16	2	2	Ma.31,Ap.10	Q	0.10
Dome Mines	New York	7 3/4	7 1/2	7 1/2	Ap.18, My5,	Q	0.25
Golden Cycle	Colo.Springs	†1.68	†1.66	...	My.31,Jn.10	Q	0.04
Hollinger Consol	Toronto	19.98	19.50	19.90	Jn. 1, Jn 17		0.10
Homestake Mining	New York	60 1/4	60	60	My.20,My.25	M	0.50
Kirkland Lake	Toronto	1.45	1.25	1.44			
Lake Shore	Toronto	20.40	19.75	19.75	Jn.1, Jn.1	X	0.20
McIntyre-Porcupine	New York	25	25	25	My.2, Jn.1	Q	0.25
Portland	Colo.Springs	†*47	†*42	...	Ap.6, Ap.15,	Q	0.02
Rand Mines	New York	...	...	9 1/2	Au.23-30	Am.Sh.	1.52
Teck-Hughes	Toronto	7.70	7.35	7.43	Ja.31, Fe.1		0.05
Tom Reed	Los Angeles	*40	*38 1/2	*38 1/2	Dec., 1926		0.02
Tough-Oakes	Toronto	*55	*44 1/2	*55			
United Eastern	N. Y. Curb	*35	*35	*35	July, 1924		0.05
Vipond Cons	Toronto	*97	*77	*93	Apr.1, Apr.15		0.03
Wright-Hargreaves	Toronto	6.10	5.85	5.86	Ap.15,My.2		0.10
GOLD AND SILVER							
Carnegie Metals	Pittsburgh	12	12	12			
Con. Cortez	N. Y. Curb	*19	*19	*19			
Con. Virginia	San Francisco	*4 1/2	*3 1/2	*3 1/2			
Dolores Esperanza	N. Y. Curb	*64	*64	*64	July, 1923		0.05
Premier Gold	N. Y. Curb	2 1/8	2	2	Ma.15, Ap. 4	Q	0.08
Tonopah Belmont	N. Y. Curb	...	...	1 1/16	Ma.15, Ap.4		0.08
Tonopah Extension	N. Y. Curb	*24	*24	*24	Apr. 1925		0.05
Tonopah Mining	N. Y. Curb	...	...	2 3/4	Ma.31, Apr.21		0.07 1/2
West End Consol	N. Y. Curb	*9	*9	*9	Mar., 1923		0.05
Yukon Gold	N. Y. Curb	...	...	*45	June, 1918		0.02
SILVER							
Beaver Consol	Toronto	1.15	1.00	1.15	May, 1920		0.03
Canadian Lorrain	Toronto	*25	*19 1/2	*25			
Castle-Trethewey	Toronto	*95	*80	*95			
Coniagas	Toronto	...	...	3.50	May, 1924		0.12 1/2
Keeley	Toronto	1.28	1.17	1.28	Fe.28, Ma.15	X	0.12
Lorrain Trout Lake	Toronto	*86	*78	*85	July, 1925		0.05
McKinley-Dar.-Sav	Toronto	*16 1/4	*16	*16 1/4	Oct., 1920		0.03
Mining Corp. Can	Toronto.	3.15	3.00	3.10	De. 30, Ja. 15		0.12 1/2
Nipissing	N. Y. Curb.	6	5 3/8	5 3/8	Ma.31,Ap.20	Q	0.15

Stock	Exch.	High	Low	Last		Last	Div.
SILVER-LEAD							
Ahumada	New York	3 1/4	2 3/4	3	Ma. 25,Ap.4,QX		0.12 1/2
Bingham Mines	Boston	44 1/2	44	44	Ma.21, Ap. 5	Q	1.00
BunkerHill&Sullivan	N. Y. Curb	103	82	90	My.31, Jn.4	X	0.50
Cardiff M. & M	Salt Lake	*50	*40	*50	Feb. 5, 1927		0.10
Chief Consol	Salt Lake	2.40	2.40	2.40	Nov., 1926	Q	0.10
Consti'nMng.&Mill'g	Spokane	*33 1/2	*30	*33			
Erupcion	Boston Curb	*49	*48	*49	Ma. 25, Ap. 2	Q	0.07 1/2
Eureka Lily	Salt Lake	1.40	1.35	1.35			
Federal M. & S.	New York	137	134 1/2	134 1/2			
Federal M. & S. pfd.	New York	96 3/8	95 1/2	95 1/2	My.25, Ju.15	Q	1.75
Hecla Mining	N. Y. Curb	14 5/8	14 1/4	14 3/8	My.4, Ju. 15	Q	0.25
Highland-Surprise	Spokane	9.00	8.50	9.00			
Iron King Mining	Salt Lake	*56	*45	*56			
Keystone Mining	Salt Lake	*28	*26 1/2	*26 1/2	Au. 12, Au. 26		0.07 1/2
Lucky Jim	Spokane	*20 1/2	*20 1/4	*20 1/2			
Lucky Tiger-Com	Kansas City	†6.75	†6.50	...	My. 10, My. 20		0.05
Mammoth Mining	Salt Lake	1.85	1.85	1.85	Jn.10, Jn.20	Q	0.05
Marsh Mines	Spokane	1 3/8	1	1 3/8			
North Lily	Salt Lake	3.20	2.90	3.20			
Park Utah	New York	7	6 3/8	6 3/8	Jn. 25, Jy. 1	Q	0.20
Plutus Mining	Salt Lake	1.85	1.80	1.85	Ja. 10, Ja. 15	Q	0.10
San Rafael	San Francisco	...	...	*24			
Silver King Coal	Salt Lake	7.80	7.65	7.75	Jn. 20, Jy. 1		0.25
Silversmith	Spokane	*40 1/2	*36 1/2	*40 1/2	Oct., 1926	Q	0.02
Stratton Mines	Spokane	*44 1/2	*43	*43			
Sunshine M. Co.	Spokane	*93	*82	*85			
Tamarack-Custer	Spokane	*26	*23 1/2	*26	Sept., 1924		0.25
Tintic Standard	Salt Lake	11.00	10.87 1/2	11.00	Jn.15, Jn.28		0.40
Utah-Apex	Boston	5 1/8	5	5	Oct., 1926		0.25
IRON							
Bethlehem Steel	New York	52 3/8	50 1/4	50 1/2	July, 1924		1.25
Cleveland-Clifs Iron	Cleveland	78	77 1/2	77 1/2	Ja. 15, Ja. 25	Q	1.00
Colorado Fuel & Iron	New York	91 1/2	86 1/2	88 1/2	May, 1921		0.75
Gt. North'n Iron Ore	New York	20 1/2	19 3/8	19 1/2	Dec. 6, Dec. 28		0.75
Inland Steel	New York	51 3/4	45 1/2	50 3/4	My. 13, Jn. 1	Q	0.62 1/2
Replogle Steel	New York	...	...	12 1/2			
Republic I. & S.	New York	69 1/2	66 1/8	66 1/4	My. 14, Jn. 1	Q	1.00
Republic I. & S. pfd.	New York	106	105 1/2	105 1/2	Jn. 14, Jy. 1	Q	1.75
Sloss-Sheffield S. & I.	New York	130	128	129	Jn. 10, Ju. 20	Q	1.50
Sloss-Shef. S.&I. pfd.	New York	107 1/2	107	107 1/2	Jn. 20, Jy. 1	Q	1.75
U. S. Steel	New York	125 1/4	123 1/8	124 5/8	Jn. 7, Jn. 29	Q	1.75
U. S. Steel, pfd.	New York	133	132 1/4	132 3/8	My. 2, My. 28	Q	1.75
Virginia I. C. & C	New York	45 1/2	45 1/2	45 1/2	Jan., 1924		1.50
Virginia I.C.&C. pfd.	New York	....	....	60 1/2	Ju. 15, Jy. 1		2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN							
De Beers Consol	New York	....	....	30 1/8	Ja. 26, Ja. 29		1.45
So. Am. G. & P. New	N. Y. Curb	3	3	3			
Alum. Co. of Amer	N. Y. Curb	69	68	69			
Alum. Co. ofAmer.pf	N. Y. Curb	104	103 3/4	104	Ma. 15, Ap. 1	Q	1.50
Vanadium Corp	New York	51	45 1/4	48 7/8	My. 2, My. 16	Q	0.75
Patino M. & E	New York	21 3/8	20 3/8	21	Ap. 27, My. 5		1 sh.
ASBESTOS							
Asbestos Corp	Montreal	25	24	24	Jan., 1926		1.50
Asbestos Corp. pfd.	Montreal	88 3/4	87 1/4	88	Ma.31, Ap.15	Q	1.75
SULPHUR							
Freeport, Texas	New York	68 3/4	65 7/8	66 1/4	Ap. 15, My. 2	Q	1.00
Texas Gulf	New York	61	58 3/8	59	Ju. 1, Ju. 15	Q	1.00
MINING, SMELTING, REFINING AND GENERAL							
Amer. Metal	New York	41 1/2	41	41	My. 20, Ju. 1	Q	0.75
Amer. Metal, pfd.	New York	109 3/4	109 3/8	109 3/4	My. 21, Ju. 1	Q	1.75
Amer. Sm. & Ref.	New York	167 1/4	158 3/8	162	Ap.14, My.2	Q	2.00
Amer. Sm. & Ref. pfd.	New York	125	124 1/4	125	My. 6, Jn. 1	Q	1.75
Consol. M. & S.	Montreal	249	245	245	De.31, Ja. 15	X	6.25
Newmont Mining	N. Y. Curb	73	72 3/8	73	Ma.31, Ap.15	Q	0.60
U. S. Sm. R. & M.	New York	36 3/8	36 1/4	36 3/8	Ap. 7, Ap. 15	Q	0.87 1/2
U.S. Sm. R.&M. pfd.	New York	48 1/4	48	48 3/8	Ap. 7, Ap. 15	Q	0.87 1/2

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

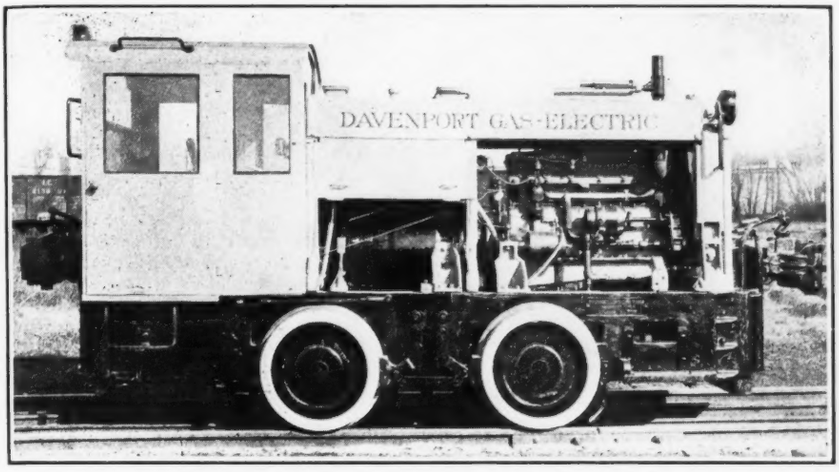
Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED May 23, 1927

Name	High	Low	Last	Date	Last Div. Amount
Aramayo Mines (25 frs.)	88/9	88/1 1/2	88/9	May, 1927	5 p.c. (†)
British Platinum (£1)	3/3	2/6	3/—	Feb., 1925	2 1/2 p.c.
Burma Corpn. (10 rupees)	15/6	14/10 1/2	15/1 1/2	Feb., 1927	6 annas*
Bwana M'Kubwa (5s)	6/1 1/2	5/7 1/2	5/10 1/2		
Camp Bird (2s)	4/6	3/10 1/2	4/6		
El Oro (£1)	4/3	4/—	4/3	Nov., 1924	2 1/2 p.c.*
Esperanza (10s)	—/1 1/2	—/1 1/2	—/1 1/2		
Frontino & Bolivia (£1)	13/—	12/6	12/6	Jan., 1927	5 p.c.
Mexican Corpn. (£1)	11/9	10/7 1/2	11/3		
Mexico Mines of El Oro (£1)	19/4 1/2	17/6	18/9	Dec., 1926	3 3/4 p.c.*
N'Changa Copper Mining	13/1 1/2	10/7 1/2	11/3		
Oroville Dredging (£1)	6/6	6/3	6/3	Dec., 1923	3 1/2 p.c.
Ouro Preto (£1)	2/—	2/—	2/—	May, 1925	2 1/2 p.c.
Rhodesian Congo Border (£1)	60/—	56/3	60/—		
St. John del Rey (£1)	12/1 1/2	11/3	11/6	May, 1927	3 1/2 p.c.
San Francisco Mines (10s)	32/10 1/2	31/9	32/3	Jan., 1927	25s.
Santa Gertrudis (£1)	17/9	16/4 1/2	17/6	Jan., 1927	3 1/2 p.c.
Selukwe (2s. 6d.)	9/6	8/6	8/9	April, 1917	6 1/2 p.c.
S. Amer. Copper (2s.)	3/3	3/—	3/—	Nov., 1917	75 p.c.
Tanganyika (£1)	63/6	50/3	50/7 1/2	Aug., 1926	7 1/2 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.690	9.000	9.690	July, 1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation.

New Machinery and Inventions



This locomotive with its gas-electric drive embodies great power at low operating and maintenance expense

Gas Engine With Electric Motors and Control

Continued demands by users of steam and gasoline locomotives in the industrial field prompted the Davenport Locomotive Works, Davenport, Iowa, to produce a locomotive with power equal to steam, with all its flexibility and elimination of mechanical clutch and gear transmission, relieving considerably the constant supervision, as well as cost in maintenance, of the steam-driven engine. The result is a gas-electric locomotive that can be handled by anyone.

This locomotive, it is claimed, will start a heavier train and in switching service handle more ton-miles per day than any steam or gasoline locomotive of the same weight. In principle, a generator connected directly to a gasoline engine furnishes electric current for electric motors that are applied to each axle, all the wheels being drivers. Power and speed are regulated through a controller, as in a street car. Instant starting, smooth acceleration, and close speed regulation are obtained with these engines.

This new type of motive power is, according to the manufacturers of the new engine, the most advanced step in locomotive construction ever produced. It is designed for general industrial switching, brick yards, plantations, contractors, steel mills, coal mines, quarries, cement plants, logging, and branch line railroads. Gas-electric locomotives are made in 8-, 10-, 12-, 16-, 20- and 24-ton sizes for all track gages. The three smaller sizes have four wheels and the larger sizes have two four-wheel trucks.

The arrangement of the chassis frame is such that all parts are readily accessible. In case of accident, individual removal and replacement of all parts can be made in the field. The locomotive can be serviced by any one familiar with a gasoline motor or any one familiar with electrical equipment. Any mechanic can remove and replace any part.

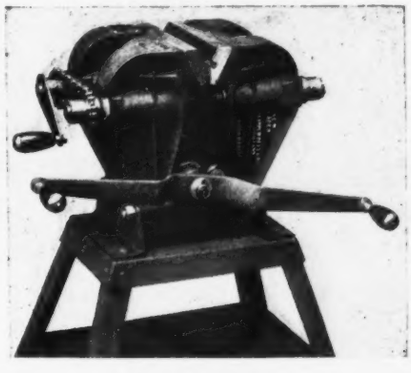
No overload can develop on the engine or operating parts. Heavy-duty, amply designed motors and control are so arranged that no abnormal voltage can be developed. There are few moving parts.

Electric power equipment on this unit is manufactured by General Electric Co. The electrical equipment is composed of a generator, controller, and heavy-duty motors, ample in capacity, practical in design. Constant dependable power to meet all conditions is provided. Infinite number of speeds as high as 35 miles per hour can be attained.

The power unit will develop up to 240 volts. When wires are attached to a removable plug in the cab electric power may be furnished for electric drills, electric hoists, electric windlass, electrical cooking appliances, or camp lighting.

Belt Lacer

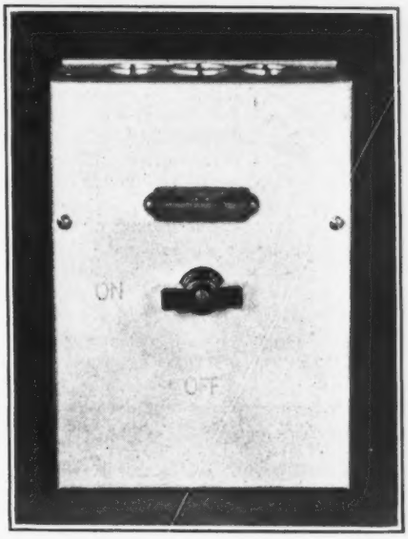
Announcement has been made by the Clipper Belt Lacer Co., Grand Rapids, Mich., of the development of its new Clipper speed lacer, which is shown in the accompanying illustration. This new lacer has been designed to handle belts up to 8 in. in width. It is claimed that by the use of an entirely new principle of operation a three-quarter turn of the crank serves to apply a pressure of 45,900 lb. to the belt, embedding the hooks in perfect alignment and flush with the surface, so that wear on the pulleys is reduced to the minimum and the life of the joint prolonged. It is stated that the smallest belt may be laced by means of this tool, the work being done with increased speed and economy.



New speed lacer

Many New Switches Added to Standard Lines

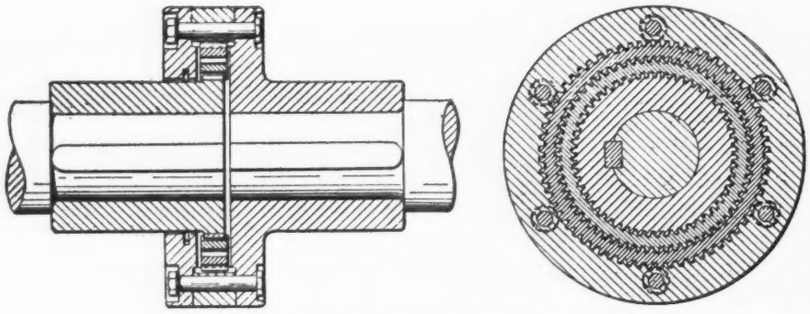
New designs of switches recently have been added by the Westinghouse Electric & Manufacturing Co., of East Pittsburgh, Pa., to its standard WK-60, WH-61, WK-62 and Midget lines. In addition to these, a new range switch, for flush or surface mounting, that is said to have many advantages, has also been introduced.



Switch has surface mounting

A complete set of designs, including solid third-wire switches of the three-blade, two-fuse type, comprises the addition to the WK-60 group. The WK-62 group has been augmented by the addition of four-wire switches consisting of four blades and three fuses for use on three-phase, grounded neutral systems. Five-wire switches, with four blades, four fuses and a solid neutral block, for use on two-phase interconnected grounded neutral systems, have also been added to this line. The new WK-61 switches consist of a 600-amp. switch and a complete range of ratings in double-throw switches, fusible at each end. N.E.C. fusible switches, solid neutral switches, and special designs for small motor work, have been added to the Midget and type "00" line of switches.

The new range switch is attractively designed for both flush or surface mounting, and is operated by a handle in the front. This switch is compactly built and neat in appearance. It is said to be particularly applicable to ranges not requiring over 40 amp. at 250 volts, or 40-amp., three-wire current at 125 volts. The rating on the type WK-22 motor starter has been increased from 5 to 10 hp. when operating at 220 volts.



Construction details of new flexible coupling

Flexible Shaft Coupling

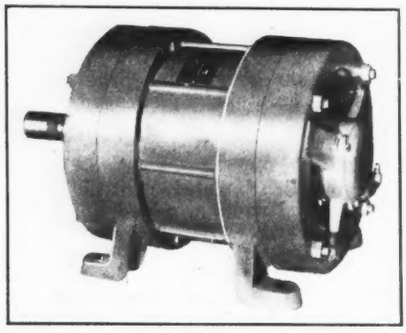
Development of the flexible coupling shown in the accompanying illustration has been announced by J. Y. Dahlstrand, Standard Turbine Corporation, Scio, N. Y. The coupling consists of two hubs keyed to the driving and driven shafts respectively, as shown in the drawing. One hub has externally hobbed claws somewhat similar to gear teeth, although not of a gear-tooth profile. The other hub has bolted to it an internally hobbed member of much larger diameter. In addition, there are one or more floating rings, one of which is split, with teeth on both the inside and outside circumferences that are interposed radially between the two hubs. The whole assembly is tightly closed and is lubricated by grease, injected through a connection in the side of the coupling.

The manufacturer makes the following statements concerning the coupling: It is made of steel throughout, so that it can be operated at high speed. It is free to move endwise to the extent of ¼ in. without imposing any thrust on either of the rotors. It is designed to permit a considerable degree of angular misalignment and to have torsional flexibility. The coupling will also take care of a certain amount of lateral misalignment, but will transmit any load imposed, even with a considerable misalignment.

Alignment of the coupling is checked by measurement with a gage furnished with it. The coupling can be disconnected to permit operation of the prime mover without running the driven machine, or vice versa, as with duplex drives, without completely dismantling it, it is stated.

All-Steel Motor Has Ball Bearings

A complete line of all-steel, ball bearing polyphase induction motors, ranging in size from 1 to 100 hp. in all standard voltages and cycles, is announced by the Lincoln Electric Co. of Cleveland, Ohio. This type of motor is representative of the new designs of equipment being brought out by the company, in which gray iron and malleable castings have been entirely replaced by hot-rolled steel.



Ball bearings and steel construction make this motor both efficient and strong

It is claimed that every part of the motor is at least twice as strong as the former type, which was built with a cast-iron frame. An example of the increase in strength of the frame is cited in the case of the motor feet. Drop-forged steel feet are welded on to the hot-rolled steel end rings of the motor. This, it is claimed, eliminates a common source of difficulty with electric motors arising from the fact that cast-iron feet are frequently broken off in rough handling. The end brackets or bearing supports are also made up of welded-steel construction, giving a complete, all-steel motor.

Economies in manufacturing by the new process have permitted the use of much larger shafts and bearings than are usually found on this type of equipment. Owing to the greater strength of steel, less thickness of metal is required in the frame. It is claimed that the increased ventilation so obtained results in a considerable increase in the overload capacity of the motor, so that a continuous overload of from 10 to 50 per cent can be handled by the motor, depending upon the size and speed.

Welding Lens

High-grade welding lenses with special properties are being manufactured and distributed by Strauss & Buegeleisen, 30 Front St., Brooklyn, N. Y., under the name of Immunite. According to the manufacturers, the special properties of the lenses are that they are absolutely optically ground and polished to exact plano and are claimed to be the best filter for injurious light rays yet devised. It is stated that this lens meets the requirements of the U. S. Navy specifications, and that it can be ordered and specified by shade numbers.

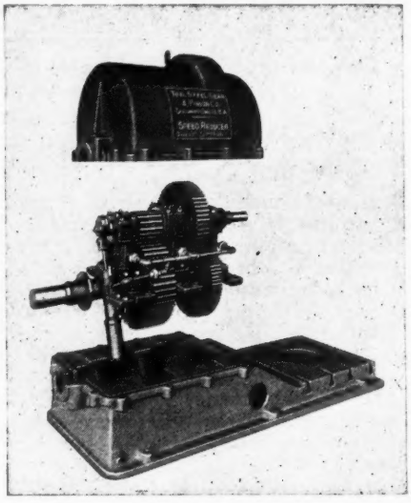
Each piece of Immunite will bear a certificate, giving its absorption of ultra-violet and infra-red rays, with the amount of visible and total energy transmitted.

Speed Reducers

Marketing of its speed reducers has been announced by the Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

In the standard models plain spur gears with a 20-deg. stub tooth are used, although helical gears will be furnished, if desired, at slight extra cost. The gears are made of tool steel. All shafts are chrome-nickel steel, heat-treated and ground. Bronze bushings are used throughout, although ball or roller bearings can be supplied. These bushings are said to be of liberal design and are made of an alloy that is especially resistant to shocks and wear.

Forced lubrication to all bearings is supplied by a suction pump of simple design that is supported by the lower housing and driven by an eccentric on a slow-speed shaft. This pump, which contains no packings, springs, or stem



Tool-steel speed reducer

valves, will, it is claimed, handle oils ranging from the highest to the lowest viscosity. Particular care has been taken to prevent oil leaks, by a buffer joint in the lower housing and through the use of deflector rings and felt wipers in the packing boxes for the shafts.

The design of this reducer is said to be unusually strong and compact, and particular attention has been given to accessibility for inspection or replacement of parts.

Catalogs

Architect's Specifications—A booklet covering almost any passenger or freight elevator installation is included in Warner's List of Architect's General Specifications.—The Warner Elevator Mfg. Co., Cincinnati, Ohio.

Lubricating Outfit—A number of circulars describe the G & B circular and rectangular tanks for storing and measuring lubricating oils.—Gilbert & Barker Manufacturing Co., Springfield, Mass.

Steel Melting Furnaces—Steel melting with Ajax-Northrup high-frequency furnaces is described and illustrated in a leaflet.—Ajax Electrothermic Corp., Trenton, N. J.